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END

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project Description.

B. Scope of Work.

C. Construction Phasing.

D. Demolition.

E. Work Restrictions.

F. Utilities.

G. Street Closings.

H. Specification Conventions.

I. Color/Finish Sample Boards.

1.2 PROJECT DESCRIPTION

A. This project provides for the construction of a new addition to the existing tool room in Hangar No. 2

B. The construction contract will include site work, foundation, exterior closure to match existing facility, roof system, utilities, extension of existing HVAC and fire protection systems, restoration of disturbed areas and relocation of communications ducting and electrical supply line.

1.3 SCOPE OF WORK

A. This project provides the design and construction of an approximately 750 square foot addition to the tool room in Building 210 (Hangar No. 2). The site must be prepared to establish final grade elevations and allow for proper drainage. The facility construction will include site work, foundation, a metal roof system, structural framework, exterior enclosure, interior finishes, extension of the existing HVAC and fire protection systems, relocation of existing communication ducting and electrical service and restoration of disturbed areas. The new facility should include all structural and glazing to meet AT/FP standards. All exterior and interior finishes will be coordinated with Laughlin Air Force Base. The project must meet all Air Force and state codes.

1.4 CONSTRUCTION PHASING

A. This construction project will be done in one phase.

1.5 DEMOLITION

A. The existing exterior wall will need to be demolished to accommodate the new space adjacent to it. Also, the site will need to be cleared, including demolition of a sidewalk and relocation of two communications conduits.

1.6 WORK RESTRICTIONS

A. Noise Level
   1. Work to be performed is adjacent to an active airfield, noise level may be high as jet aircraft may be landing and taking off in the vicinity.

B. Working Hours
   1. Working hours are Monday through Friday, 0730 to 1630 hours.

C. Security Requirements
   1. For the duration of this Contract, access to the Installation may be delayed between 30 minutes to an hour or more due to security precautions, including the checking of vehicle occupants' IDs, vehicle manifests, and the searching of all vehicles. Any general or specific threat to the safety of those working or living at Laughlin AFB could result in longer waiting times at the access points to Laughlin AFB.
   2. All Contractor's must maintain a photo ID on their person (such as a valid driver's license) along with the issued AF Form 75, "Visitor Pass" or the Laughlin AFB Computer Generated Contractor Pass.
   3. The following are requirements for contractor employees entering Laughlin AFB:
      a. One form of picture ID and Social Security card
      b. A memo from the construction company on their letterhead stating the reason for entry, contract number, and the location at Laughlin AFB where the jobsite is located.
      c. All delivery trucks must have a bill of laden and delivery truck drivers must have a picture ID.
   4. All employees utilizing privately owned vehicles on Laughlin AFB must obtain a vehicle pass from the Pass and Registration Office. At the time of registration, the driver must provide proof of valid insurance meeting the minimum liability insurance requirements, a valid driver's license and current state registration. ***Note:*** *If the vehicle is not registered in the employee's name, the registrant must have a legal bill of sale, a vehicle title in his/her name, or notarized letter from owner authorizing registrant to operate the vehicle.*

1.7 UTILITIES

A. Payment for Utility Services

1. In accordance with Contract Clause 52.236.14 AVAILABILITY AND USE OF UTILITY SERVICES, water and electricity are available from Government-owned and operated systems and will be furnished to the Contractor. The Contractor shall be responsible for installing separate meters on utility lines from which service is obtained.
2. Outages
   a. The Contractor shall coordinate all requests for utility outages with the Contracting Officer in writing 14 days prior to date of requested outage:
      1) Water, gas, steam, and sewer outages shall be held to a maximum duration of 4 hours unless otherwise approved in writing.
      2) Electrical outages shall have a maximum duration of 4 hours.

1.8 STREET CLOSINGS

A. The Contractor shall coordinate all requests for street closings with the Contracting Officer in writing 14 days prior to date of requested outage:
   1. One lane traffic shall be maintained at all times.
   2. The final street repair shall be completed within 14 days after the start of any street crossing. Any part of the street returned to service prior to final repair shall be maintained smooth with hot-mix cold-lay surface course.
   3. One lane traffic shall be maintained at all times; at least two flag persons will be on duty to assist traffic in the open lane, when other lanes are closed due to the Contractor's operations. Flag persons will meet the requirements of Item 7.7 of the Texas State Department of Highways and Public Transportation Standard Specifications for Construction of Highways, Streets, and Bridges, 1982 Ed.

1.9 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

B. The Contractor is to comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship. The Contractor shall ensure that all work is in accordance with all laws, ordinances, regulations, and codes governing the type of work being done on the job site. Any additional work or furnishing of materials required due to inspection by authorities will be furnished at no additional cost to the Government.

C. Omissions from the drawings or specifications or the misdescription of details or work which are manifestly necessary to carry out the intent of the drawings or specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but

they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

PART 2 PRODUCTS

2.1 COLOR/FINISH SAMPLE BOARDS

A. Color/finish board(s) shall have attached samples of all interior appearance related construction items the Contractor proposes to furnish, including, but not limited to, such items as interior paints and finishes; wall covering; trim items; carpet; floor, wall and ceiling tiles; doors; cabinet work, signage, etc. Each sample shall indicate color, texture, and finish; and, if patterned, shall be large enough to define full pattern. Samples shall be identified as to type of material, area of installation, manufacturer, and transmittal number under which certification of the material represented has been submitted in accordance with the requirements of Section 01330.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01101

SPECIAL PROVISIONS FOR LAUGHLIN AFB

PART 1 GENERAL

1.1 LOCATION OF WORK

A. The work will be done in the vicinity of Building 380.

1.2 EQUIPMENT PARKING

A. The Government shall not be liable for the security of any of the Contractor's equipment or materials while on Laughlin AFB, TX.

PART 2 PRODUCTS

2.1 The products to be used in the work under this contract are described in the other sections of these specifications.

PART 3 EXECUTION

3.1 TRAFFIC CONTROL

A. The Contractor shall provide all traffic control devices within the project limits and on all haul routes. The Contractor shall be responsible for maintaining all areas of new construction until accepted by the Government.

3.2 HAULING MATERIAL

A. Material shall be hauled in vehicles equipped with pneumatic tires. Hauling of materials shall comply with state and local regulations, including seasonal load limitations. The Contractor shall be responsible for establishing and maintaining on-Base and off-Base haul routes.

3.3 WORK PERFORMANCE

A. The Contractor shall conduct all work, including materials distribution in an orderly manner with minimum disturbance and inconvenience to traffic operations. The Contractor shall confine and limit personnel to only those areas required for work performance. All work shall be performed in a neat, orderly fashion, with extreme care exercised to avoid damage to all property in and around the project areas. Any damage caused by the Contractor shall be replaced, repaired, or restored at no cost to the Government. Upon completion, all work and storage areas shall be cleaned of all evidence of Contractor's debris

accumulations within 21 days of acceptance by the Government. At the close of each days Contractor operations, all excess materials and equipment shall be moved to the storage area designated by the Contracting Officer or his designated representative. The Contractor's proposed work schedule shall be coordinated with Laughlin AFB's Airfield Manager and the Contracting Officer or his designated representative 14 days prior to the start of work. All work areas shall be barricaded as shown on the drawings.

3.4 PERMITS, WORK CLEARANCES AND SAFETY

A. The Contractor shall obtain from the Contracting Officer's representative a copy of the AF Form 103, "Base Civil Engineering Work Clearance Request" at least three (3) weeks in advance of starting work. Prior to start of work, all Contractor personnel that will be operating vehicular equipment within the airfield shall apply for flight line licenses from Laughlin AFB Base Operations through the Contracting Officer. All personnel working on the project must attend a flight line safety class before being authorized to access site. The Contractor shall strictly adhere to the requirements of UFC 3-260-01 paragraph A15.6 Operational Safety on the Airfield During Construction. An electronic copy of UFC 3-260-01 AIRFIELD AND HELIPORT PLANNING AND DESIGN can be attained from website http:/65.204.17.188/report/doc_ufc.html.

3.5 SWEEP AIRFIELD PAVEMENTS

A. Any debris created by the contractor within the airfield controlled area that may result in foreign object damage shall be removed immediately. The Contractor shall continuously clean airfield pavements used as haul routes.

3.6 LIGHTING FOR NIGHT WORK

A. The Contractor shall be responsible for providing all lighting fixtures and power sources. The Contractor shall coordinate all night time lighting with Laughlin AFB's Civil Engineering office, the Airfield Manager, and the Contracting Officer or his designated representative prior to the starting night time operations.

3.7 RADIO COMMUNICATIONS

A. No radio communications required.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Contractor Verification of Contract Survey Data.

D. Preconstruction meeting.

E. Progress schedules/progress reports

F. Partnering meetings.

G. Cutting and patching.

H. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Employ Land Surveyor registered in the State of Texas.

B. Locate and protect survey control and reference points. Promptly notify Contracting Officer of discrepancies discovered.

C. Control datum for survey is that shown on Drawings.

D. Verify set-backs and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit copy of site drawing signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

G. Maintain complete and accurate log of control and survey work as Work progresses.

H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

J. Promptly report to Contracting Officer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Contracting Officer.

1.4 CONTRACTOR VERIFICATION OF CONTRACT SURVEY DATA

A. During initial site layout and before existing conditions are disturbed the Contractor shall verify, in writing, the basic survey data provided on the contract drawings. Verification shall be initiated from the point shown on the contract drawings or from the contract drawing reference point designated by the Contracting Officer's Authorized Representative and shall include, as a minimum, benchmark elevations, horizontal control points, and sufficient spot checks of critical elevations to ensure that the survey data adequately reflects existing conditions. The Contractor shall not proceed with construction until survey verification is provided to the Contracting Officer's Authorized Representative. Before an existing benchmark referenced on the contract drawings is disturbed

the Contractor shall establish a new benchmark which has been approved by the Contracting Officer's Authorized Representative. Benchmarks which are destroyed without authorization from the Contracting Officer's Authorized Representative must be replaced at the Contractor's expense as prescribed in Section 00700 Contract Clause, "Layout of Work." The Contractor shall refer to Contract Clauses, "Differing Site Conditions" and "Site Investigation and Conditions Affecting the Work," for additional requirements.

1.5 PRECONSTRUCTION MEETING

A. Contracting Officer will schedule meeting after Notice of Award.

B. Attendance Required: Contractor’s Project Manager, Contractor’s Superintendent, and all major subcontractors.

C. Agenda:
1. Construction Schedule
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing parties in Contract.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Use of areas of the site.
9. Delivery and Storage.
10. Safety.
11. Security
12. Clean up.

1.6 PROGRESS SCHEDULES/PROGRESS REPORTS

A. Submit three (3) copies to the Contracting Officer for approval, **within five (5) days after the Notice to Proceed**, a Contract Progress Schedule. The progress schedule shall show the major work elements and the order in which it is proposed to carry out the work.

B. Submit Contract Progress Report to the Contracting Officer for approval within **one (1) working day** of completion of each two-week interval, indicating the percentage of work completed for each major work element on the approved schedule.

C. Failure to submit the schedule and reports within the time required or failure to maintain progress in accordance with your progress schedule may result in withholding of payment and/or other action as deemed appropriate by the Contracting Officer.

1.7 PARTNERING MEETINGS

Partnering meetings will be held throughout the project on a weekly basis to discuss work progress. The Contractor's superintendent shall attend.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07840 to full thickness of penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

K. Identify hazardous substances or conditions exposed during the Work to Contracting Officer for decision or remedy.

3.2 SPECIAL PROCEDURES

A. Materials: As specified in product sections; match existing with new products for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to permit installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Contracting Officer for review.

L. Where change of plane of ¼ inch or more occurs, submit recommendation for providing smooth transition; to Contracting Office for review.

M. Trim existing doors to clear new floor finish. Refinish trim to original or specified condition.

N. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Submittal Register.

C. Product data.

D. Shop drawings.

E. Samples.

F. Design data.

G. Certificates.

H. Erection drawings.

1.2 SUBMITTAL PROCEDURES

A. Transmit three (3) copies of each submittal with a completed AF Form 3000.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

D. The Contractor will sign the AF Form 3000 certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

E. Schedule submittals to expedite Project, and deliver to Contracting Officer at designated location. Coordinate submission of related items.

F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Consultant review stamps.

I. When revised for resubmission, identify changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

K. Submittals not requested may not be recognized or processed.

1.3 SUBMITTAL REGISTER

A. At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals my be required. The Government will provide the initial submittal register in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall track all submittals.

1.4 PRODUCT DATA

A. Product Data: Submit to Contracting Officer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit to Contracting Officer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.6 SAMPLES

A. Samples: Submit to Contracting Officer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Samples For Selection as Specified in Product Sections:
1. Submit to Contracting Officer for aesthetic, color, or finish selection.
2. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Contracting Officer selection.

C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

D. Include identification on each sample, with full Project information.

E. Submit number of samples specified in individual specification sections; Contracting Officer will retain one sample.

F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01700.

1.7 DESIGN DATA

A. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Contracting Officer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Contracting Officer.

1.9 ERECTION DRAWINGS

A. Submit drawings for Contracting Officer's benefit as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Contracting Officer or Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01354

ENVIRONMENTAL MANAGEMENT
07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ARMED FORCES INSURANCE (AFI)

AFI 32-7086	(1 Nov 2004) HAZMAT procedures

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z400.1	(1993; R 2004) Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation

ASTM INTERNATIONAL (ASTM)

ASTM D 4840	(1988; R 2004) Sampling Chain-Of-Custody Procedures
ASTM D 5663	(1995; R 2003) Validating Recycled Content in Packaging Paper and Paperboard
ASTM E 1991	(1998) Environmental Life Cycle Assessment of Building Materials/Products
ASTM E 2114	(2000; R 2005) Standard Terminology for Sustainability Relative to the Performance of Buildings

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 14040	(1997) Environmental Management - Life Cycle Assessment - Principles and Framework

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

BEES 3.0c	(2002) Building for Environmental and Economic Sustainability

U.S. DEPARTMENT OF AGRICULTURE (USDA)

Biomass R&D Act	(2000) Biomass Research and Development Act
U.S. Farm Bill	(2002) U.S. Farm Bill of May 2002

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

40 CFR 261	(1997; R 2004) Identification And Listing Of Hazardous Waste
Contractor 40 CFR	(1997; R 2004) Protection of Environment
NPDES	(1972; R 2005) National Pollutant Discharge Elimination System

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114 and as specified.

a. "Biobased content" is calculated as the weight of the biobased material divided by the total weight of the product, and is expressed as a percentage by weight.

b. "Biobased materials" include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by the Biomass R&D Act. Minimum biobased content shall be as defined in the U.S. Farm Bill.

c. "Chain-of-custody" is a process whereby a product or material is maintained under the physical possession or control during its entire life cycle.

d. "Pollution and environmental damage" is caused by the presence of chemical, physical, or biological elements or agents. Human health or welfare is adversely affected; ecological balances are unfavorably altered; the utility of the environment for aesthetic, cultural, or historical purposes degrades.

1.3 PRECONSTRUCTION MEETING

After award of Contract and prior to commencement of the work, the Contractor shall schedule and conduct a meeting with the Contracting Officer to discuss the proposed Environmental Protection Plan and to develop a mutual understanding relative to the details of environmental protection. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting as specified in Section 01400.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G

Instructor Qualifications

Submit reference data to demonstrate instructors' individual and firm's capabilities and experience.

SD-03 Product Data

Life Cycle Assessments

Packaging; (LEED)

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

SD-06 Test Reports

Field Quality Control Reports

SD-07 Certificates

Environmental Regulatory Requirements

For Government's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with environmental regulations bearing on performance of the work.

SD-08 Manufacturer's Instructions

Material Safety Data Sheets

SD-11 Closeout Submittals

Training Program

Submit two copies of instructional program outline for demonstration and training, including a schedule of dates, times, length of instruction, instructors' names, learning objective, and teaching outline for each training module. At completion of training, submit one complete training manual[s] for Government's use, and a list of participants with each participant's results of performance-based test for each training module. For Government's records, submit Contractor 40 CFR employee training records upon request of the Contracting Officer.

Protection of Natural Resources

1.5 CONTRACTOR'S ENVIRONMENTAL MANAGER

Designate an on-site Environmental Manager responsible for overseeing the environmental goals for the project and implementing procedures for environmental protection.

1.5.1 Duties

The Environmental Manager shall be responsible for the following:

a. Compliance with applicable federal, state, and local environmental regulations, including maintaining required documentation.

b. Implementation of the Waste Management Plan.

c. Implementation of the Indoor Air Quality (IAQ) Management Plan.

d. Implementation of the Environmental Protection Plan.

e. Environmental training for Contractor personnel in accordance with their position requirements.

f. Monitoring and documentation of environmental procedures.

1.5.2 Qualifications

Minimum 5 years construction experience on projects of similar size and scope; minimum 2 years experience with environmental procedures similar to those of this project; familiarity with Environmental Management Systems (EMSs); familiarity with environmental regulations applicable to construction operations.

1.6 ENVIRONMENTAL REGULATORY REQUIREMENTS

The Contractor shall be responsible for knowing federal, state, and local regulatory requirements pertaining to legal disposal of all construction and demolition waste materials. Comply with all applicable regulations and maintain records of permits, licenses, certificates, and other environmental regulatory requirement correspondences.

1.7 ENVIRONMENTAL REQUIREMENTS FOR PRODUCTS

1.7.1 Material Safety Data Sheets (MSDS)

Submit an MSDS for each product specified in other sections or required by OSHA to have an MSDS. MSDS shall be prepared within the previous five years. Include information for MSDS Sections 1 through 16 in accordance with ANSI Z400.1 and as follows:

a. Section 11: Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects.

b. Section 12: Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in the event of an accidental release.

c. Section 13: Include data regarding the proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not the product is considered to be "hazardous waste" according to 40 CFR 261.

d. Section 14: Identify hazard class for shipping.

e. Section 15: Identify federal, state, and local regulations applicable to the material.

f. Section 16: Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts.

1.7.2 Life Cycle Assessments (LCAs)

For the following products, submit LCA data developed in accordance with ASTM E 1991 or ISO 14040;and where BEES data exists, submit BEES 3.0c analysis using 50 percent Environmental Performance Weighting and the EPA Scientific Advisory Board Environmental Impact Category Weights.

a. Masonry

b. Finish Carpentry

c. Plastic Fabrications

d. Building Insulation

e. Roofing

f. Joint Sealers

g. Wood & Plastic Doors

h. Windows

k. Gypsum Board

l. Tile

m. Acoustical Ceilings

n. Resilient Flooring

o. Carpet

p. Toilet Compartments

r. Office Equipment

s. Furnishings & Accessories

t. Renewable Energy Equipment

v. HVAC equipment

x. Lighting equipment

1.8 ENVIRONMENTAL PROTECTION PLAN

Prepare and submit an Environmental Protection Plan not less than 10 days before the preconstruction meeting. At a minimum, address the following elements in accordance with this section:

a. Identification and contact information for Environmental Manager.

b. General site information, including preconstruction description and photographs.

c. Summary of training program.

d. Procedures to address water resources.

e. Procedures to address land resources.

f. Procedures to address air resources.

g. Procedures to address fish and wildlife resources.

h. Monitoring and quality control procedures.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

1.9 ENVIRONMENTAL DEMONSTRATION AND TRAINING

Contractor shall provide environmental training for workers performing work on the project site.

1.9.1 Instructor Qualifications

Training shall be given by a firm or individual experienced in providing training or education similar in content and extent to that indicated for this project.

1.9.2 Coordination

Coordinate instruction schedule with Government operations. Adjust schedule as required to minimize disruption of Government operations. Coordinate instruction with demonstration and training of general building systems.

1.9.3 Training Program

Develop a training program for all site workers that includes the following topics:

a. Overview of environmental and sustainability issues related to the building industry.

b. Overview of environmental and sustainability issues related to the project.

c. Compliance with applicable federal, state, and local environmental regulations.

d. Review of site specific procedures and management plans implemented during construction, including the Waste Management Plan, Indoor Air Quality (IAQ) Management Plan, Environmental Protection Plan, and procedures for noise and acoustics management.

1.9.3.1 Scheduling

Provide instruction at mutually agreeable time[s].

1.9.3.2 Training Modules

Develop a learning objective and teaching outline for each topic in the Training Program. Include a description of specific skills and knowledge that each participant is expected to acquire. Instructors shall be well-versed in the particular topics that they are presenting.

1.9.3.3 Evaluation

At the conclusion of each training module, assess and document each participant's understanding of the module by use of an oral or a written performance-based test.

1.10 HAZMAT PROCEDURES

1.10.1 General

All contractors must be in compliance with Section 2.5.5 of AFI 32-7086 “HAZMAT Determination and Authorization Proce-dures for Contractors” in order to meet Federal, State, and Local requirements.

1.10.2 Additional MSDS Requirements

The contractor will submit MSDS’s and “Contractor HAZMAT Notification Form” to the contracting office no later than 15 days prior to contract start date.

1.10.3 HAZMAT Usage Logs

The contractor will submit HAZMAT usage logs to the contract-ing office specifying the manufacture, unit of issue, material safety data sheet (MSDS) date, and quantity used for all materials tracked by the installation hazardous materials management pro-gram (IHMP). HAZMAT usage logs must be submitted by contract end date or 31 Dec of each Calendar Year (CY), which-ever comes first.

PART 2 PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

Consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and disposal of products, and provide products and materials with the least effect on the environment, determined by LCA analysis, released toxins, and other methods.

2.1.1 Prohibited Materials

The use of the following materials is prohibited:

a. Products containing asbestos.

b. Products containing urea formaldehyde.

c. Products containing polychlorinated biphenyls.

d. Products containing chlorinated fluorocarbons.

e. Solder or flux containing more than 0.2 percent lead and domestic water pipe or pipe fittings containing more than 8 percent lead.

f. Paint containing more than 0.06 percent lead.

2.1.2 Packaging

Where Contractor has the option to provide one of the listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging, and to manufacturers with policies that take back product packaging.

2.1.2.1 Industrial Paperboard

Minimum 45 percent post-consumer recycled content in accordance with ASTM D 5663.

2.1.2.2 Carrier Board

Minimum 10 percent recycled content with a minimum of 10 percent post-consumer recycled content in accordance with ASTM D 5663.

2.1.2.3 Brown Papers

Minimum 5 percent recycled content with a minimum of 5 percent post-consumer recycled content in accordance with ASTM D 5663.

2.1.3 Substitutions

Notify the Contracting Officer when Contractor is aware of materials, equipment, or products that meet the aesthetic and programmatic intent of Contract Documents, but which are more

environmentally responsible than materials, equipment, or products specified or indicated in the Contract Documents. Submit the following for initial review by the Contracting Officer:

a. Product data including manufacturer's name, address, and phone number.

b. Description of environmental advantages of proposed substitution over specified product.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Comply with applicable regulations and these specifications. Preserve the natural resources within the project boundaries and outside the limits of permanent work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by the Contracting Officer. Where violation of environmental procedures requirements will irreversibly damage the site, documentation of progress at daily intervals shall be required.

3.1.1 General Disturbance

Confine demolition and construction activities to work area limits indicated on the Drawings. Remove debris, rubbish, and other waste materials resulting from demolition and construction operations from site. Transport materials with appropriate vehicles and dispose of them off site to areas that are approved for disposal by governing authorities having jurisdiction. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways. Burning is prohibited.

3.1.2 Water Resources

Comply with requirements of the NPDES and the applicable State Pollutant Discharge Elimination System (SPDES). Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Store and service construction equipment at areas designated for collection of oil wastes. Prevent ponding of stagnant water conducive to mosquito breeding habitat. Prevent run-off from site during demolition and construction operations.

3.1.3 Land Resources

Prior to construction, identify land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the Contracting Officer. Coordinate protection practices with work specified in Division 2 SITEWORK.

3.1.3.1 Erodible Soils

Plan and conduct earthwork to minimize the duration of exposure of unprotected soils, except where the constructed feature obscures borrow areas, quarries, and waste material areas. Clear areas in reasonably sized increments only as needed to use the areas developed.

Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

3.1.3.2 Erosion and Sedimentation Control Devices

Construct or install temporary and permanent erosion and sedimentation control features as required.

3.1.3.3 Tree and Plant Protection

Protect as specified in Division 2 SITEWORK and as specified. Prior to start of construction, tag each tree and plant scheduled to remain. In the event of damage to tree or plant, the Government may, at the Contracting Officer's discretion, deduct the indicated value of the damaged tree or plant from the Contract Sum.

3.1.4 Air Resources

Comply with Indoor Air Quality (IAQ) Management Plan and as follows:

a. Prevent creation of dust, air pollution, and odors.

b. Sequence construction to avoid unnecessary disturbance to site.

c. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods as needed to limit dust and dirt rising and scattering in air. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.

d. Store volatile liquids, including fuels and solvents, in closed containers. Do not store with materials that have a high capacity to adsorb VOC emissions or in occupied spaces.

e. Properly maintain equipment to reduce gaseous pollutant emissions.

3.1.5 Fish and Wildlife Resources

Manage and control construction activities to minimize interference with and damage to fish and wildlife. Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat related to the project and critical to the survival of fish and wildlife, except as indicated or specified.

3.2 FIELD QUALITY CONTROL

Comply with requirements of agencies having jurisdiction and as specified herein. Provide field practices, shipping, and handling of samples in accordance with ASTM D 4840. Provide Field Quality Control Reports in accordance with approved Environmental Protection Plan.

-- End of Section --

SECTION 01356A
STORM WATER POLLUTION PREVENTION MEASURES
08/96

PART 1 GENERAL
1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASCE	American Society of Civil Engineers, Society of Civil Engineers, Minimum design loads for buildings and other structures
AFI32-1021	Air Force Instruction 32-1021, 24 Jan 03
AFI32-1032	Air Force Instruction 32-1032, 24 Sep 02
ANSIS	American National Standards Institute Standards
ATFP	Anti-Terrorism Force Protection Guidelines
CTL	Construction Technical Letter(s)
ETL	Engineering Technical Letter(s)
IES	Illuminating Engineering Society Lighting Handbook
UFC3-600-01	Unified Facilities Criteria: Fire Protection Engineering for Facilities, 17 April 03
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association Codes and Standards
IPC	International Plumbing Code
IMC	International Mechanical Code
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
STD DET	40-06-04 Standard Detail 40-06-04
TI	Technical Instructions
TXDOT	Texas Department of Transportation Requirements
IBS	International Building Code (2002)
UFGS	Uniform Federal Guide Specifications
UL	Underwriter's Laboratories
RDG	Laughlin AFB Design Guide
LSC	National Fire Safety Code, 2000
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
IA	The Irrigation Association
NSF	National Sanitary Foundation

Laughlin AFB Architectural Compatibility Guide
AETC Installation Excellence Guide
UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings
UFC 3-120-01, Air Force Sign Standards
ETL 02-12 Communications and Information Systems Criteria for Air Force Facilities

1.2 PROJECT DESCRIPTION

1.2.1 Project Site:

Aerospace Physiology – Building 380.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES: SD-07 Certificates Mill Certificate or Affidavit Certificate attesting that the Contractor has met all specified requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include geotextiles and preservation of mature vegetation. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur,(e.g., pavement removals, excavation, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Contractor shall propose methods for stabilization of soil which will be exposed for longer than 21 days during construction activities. Stabilization practices includes but are not limited to establishment of temporary or permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing trees and vegetation, and other similar measures. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices.

1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. excavation, embankment, and grading). Silt fences shall be installed as required. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

1.4.2.2 Straw Bale Dike

Straw Bale Dike is used for perimeter control and around unpaved perimeter of curb and surface inlet, new manhole, and trenched material from utility construction. Straw Bale Dike shall not be used in stream or swale. Straw Bale Dike shall only be used where the effectiveness is required for less than 3 months. Sediment at 1/2 height of the bale barrier shall be removed. The Contractor shall inspect Straw Bale Dike locations and ensure the bales are intact and eliminating sediment from storm runoff.

1.4.2.3 Stabilized Construction Ingress/Egress

The Contractor shall establish, inspect, and maintain the stabilized construction ingress/egress. The Contractor shall determine locations for stabilized construction entrance/egress on the Contractor's field. If possible, small entrance shall be incorporated into small lot construction.

1.4.2.4 Contractor Staging, Parking, Material Storage, Borrow and Disposal

Areas Protection Device The Contractor shall establish storm water control structures around the staging, parking, material stockpiled areas, borrow and disposal areas. The Contractor's SWPPP shall show these locations on the vicinity map and/or site drawings and identify the applicable storm water control devices. The Contractor shall inspect and maintain the control structures at these locations.

1.4.2.5 Rock Berm or Check Dam

Rock Berm or Check Dam is acceptable control structure along stream or steeply sloped or barren swales. The control structure shall have open graded rock of 4 to 8 inches diameter. The graded rock shall be secured with woven sheath of 1-inch diameter opening (maximum) and wire diameter of 20 gauge (minimum). Sediment at 1/3 height of the berm or dam shall be removed.

1.4.2.6 New and Existing Inlet Protection Device

Silt fence shall be used to prevent sediment from entering new curb and surface inlets at the paved areas, and at existing surface or curb inlet downstream from the disturbed site.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE
PHYSICAL PROPERTY TEST PROCEDURE STRENGTH REQUIREMENT
Grab Tensile ASTM D 4632 100 lbs. min.
Elongation (%) 30 % max.
Trapezoid Tear ASTM D 4533 55 lbs. min.
Permittivity ASTM D 4491 0.2 sec-1
AOS (U.S. Std Sieve) ASTM D 4751 20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed

34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide
and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 MAINTENANCE

The Contractor shall maintain the permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed
to maintain the protective measures.

3.2.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence
and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be watered in accordance with Section [02300 EARTHWORK. All silt fences shall be removed by the Contractor prior to the resumption of aircraft operations on the runway.

3.2 CONSTRUCTION PRACTICES

Dewatering Operations: The Contractor (and subcontractor) shall prevent discharge of sediment by methods of sediment control, containment, and disposal. In project areas suspected of potential toxic or petroleum products contamination, the water shall be tested to determine method of disposal.

Paving Operations: The Contractor (and subcontractor) shall avoid
discharge of pollutants to storm drains by avoiding paving in wet weather
or anticipation of such event, storing material in covered containers, covering and berming storage areas, establish control structures, cover on-site storm grates, and worker and subcontractor training. Structure Construction and Painting:

The Contractor (and subcontractor) shall prevent pollutants in storm runoff by covering, or berming material storage areas, keeping job site clean and orderly, using safer alternate products, stabilizing adjacent disturbed areas, storing material in secondary containment, protecting on-site storm drain, establish control structures, and training of workers and subcontractor.

Solid Waste Materials: Trash and uncontaminated construction debris shall be placed in appropriate covered waste containers. Waste containers shall be emptied regularly; they shall

not be allowed to overflow. The disposal area of excavated material from project construction shall not be utilized for waste disposal. Routine janitorial service shall be provided for all construction buildings and surrounding grounds. No construction waste materials, including concrete, shall be buried or otherwise disposed of on-site. The Contractor shall brief all on site personnel on good housing keeping and waste minimization.

3.3 MATERIAL MANAGEMENT

Material Delivery and Storage Practice: The Contractor (and subcontractor) shall prevent or reduce discharge of pollutants to storm water by minimizing and on-site storage of hazardous and toxic (HT) materials, storing HT in clearly labeled, corrosion-resistant containers with secondary containment at designated and COR-approved area, conducting frequent inspection, keeping current inventory of construction materials on site, training of workers and subcontractor. The storage of reactive, ignitable or flammable liquids shall comply with applicable fire codes of the project area. The Contractor shall contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements.

Material Use and Inventory: The common on-site materials are: pesticides and herbicides, fertilizers, detergents, concrete material, petroleum-based products, fertilizers, tar, asphalt, steel reinforcing bars, other hazardous chemicals such as acid, lime, solvents, curing compounds, sealants, paints, glues, fertilizers, steel reinforcing bars, etc. The Contractor (and subcontractor) shall use less hazardous, alternate or environmental friendly material. The Contractor shall have (1) a list of construction materials used on site, (2) a list of materials and associated potential pollutants, and (3) method of storage and containment in the Contractor operation specific SWPPP. The Material Safety Data Sheet for each construction material on-site shall be in the Contractor's field and operation activity specific SWPPP and will be available on request by regulator agency visitors, safety officers, or COR.

Spill Prevention and Control: The Contractor (and subcontractor) shall store HT material in covered containers and inside a fenced area, have temporary fuel storage tank bermed or contained to meet applicable Fire Code, place readily accessible spill clean-up materials, have protocol for stop work immediately, notification, clean-up, labeling, storage and packaging, transportation, disposal, record- keeping, closure activities, and provide training to workers and subcontractor for response to spills.

3.4 WASTE MANAGEMENT

Solid Waste: Solid waste materials (i.e. excess fresh concrete, grout, mortar or uncontaminated debris) shall be placed in covered containers, and recycled, if possible. Trees and shrubs from site clearing shall be used as mulching material, if possible. Packaging materials such as wood, plastic, and paper shall be recycled to the maximum extent possible and not be disposed of in a landfill. The Contractor shall designate waste containers for segregating waste (domestic, metal, aluminum or plastic). Dry paint cans shall be recycled. The Contractor shall designate waste disposal area, have routine janitorial service for all structures and surrounding grounds, and have routine schedule to service waste containers. The disposal area of excavated material from project construction shall not be utilized for waste disposal. Personnel on the job site shall be briefed on minimizing disposal to landfill by waste segregation and recycling.

Hazardous and Toxic Waste: All excess on-site material such as paints, solvents, petroleum products (fuel, oil, and grease), herbicides, pesticides, acids for cleaning masonry, concrete curing compounds, sealants, paint strippers, wastes from oil-based paint, and glues could

become HT waste. Containers of excess material shall be labeled and managed according to the labels and as recommended by the product manufacturers. If no instruction is provided, the Contractor shall turn in contained waste to the installation DRMO, the local household hazardous waste drop-off, or recycling program.

Concrete waste shall be controlled and minimized by appropriate storage methods for dry and wet materials, and controlling amount of concrete and cement mixed on site. Washout of concrete truck shall not be allowed onsite, unless otherwise approved in writing by the Contracting Officer.

Sanitary/Septic Waste: On-site sanitary facilities shall be established at a convenient location. Facility location, design, maintenance, and waste collection practices shall be approved by COR and are in accordance with local regulations. The Contractor (and subcontractor) shall have a routine schedule for waste pump out by a licensed hauler. Septic waste treatment system shall have a pre-construction permit from the local health regulating agency and have contract service with a licensed company. Temporary sanitary facilities discharging to sanitary sewer system shall be approved by the operator of the system and properly connected to avoid illicit discharges. Wastewater from water-based paint shall not be discharged as sanitary waste.

Building Exterior Cleaning or High-pressure Wash: Storm drains shall be protected by approved storm water control device. Wash onto dirt area, spade in, settle solids in pit, collect (mop up) and discharge to sanitary sewer (with approval from sewer operator). If the exterior paint contains lead exceeding the levels stated in the Consumer Safety Standard, mercury or mildewcide, the wash water shall be collected and disposed of as HT waste.

Street/Pavement Cleaning: Water used for this activity shall be minimized and sediment basin shall be used to contain wastewater. At completion of construction, the silt shall be removed and disposed of in accordance with applicable regulations, and water from the basin shall be pumped to a sanitary sewer with written approval from the COR.

3.5 VEHICLE AND EQUIPMENT MANAGEMENT

Vehicle and Equipment Cleaning: Washing shall be performed off-site at a commercial washing facility that has an oil/water separator as pre-treatment prior to sanitary sewer connection. If washing must occur on site, the wash area shall have written approval from the COR.

Vehicle and Equipment Fueling: Fueling shall be off-site. If fueling must occur on-site, a written approval shall be obtained from COR. If fueling is allowed by the COR, it shall be at a designated area, at least 50 feet away from drainage courses. Fueling operations shall avoid topping of fuel tank, avoid mobile fueling of mobile construction equipment. Fueling locations shall use secondary containment (i.e. a liquid tight berm and a impermeable liner), have a stockpile of cleanup material, and absorbent material for immediate clean-up of minor spills or other spill protection measures. A permit shall be obtained from state or local regulatory agency for all on-site fuel storage tanks. In case of spill, avoid hosing down or burial of spilled fuel, documentation, reporting to COR and regulatory agency, clean-up per regulation is required. The temporary fuel containers placed on-site shall meet the industrial standard, labeled and stored in accordance with applicable Federal, state, and local Fire codes.

Vehicle and Equipment Maintenance: Outdoor vehicle or equipment maintenance is a significant potential source of storm water pollution. Activities include engine repair, changing fluids, etc. shall be prohibited on job site.

Vehicle and Equipment Parking: All vehicle or equipment parked on-site shall have drip pan or drip cloth to catch spill or leak. Vehicle or equipment (the Contractor and the subcontractor) shall regularly inspect for leaks and schedule routine maintenance to reduce the potential for leaks.

3.6 EMPLOYEE AND SUBCONTRACTOR TRAINING

The Contractor is responsible to provide training for all workers (including the subcontractor) on the job site. The objectives in training are to provide a clear concept of activities or problems that generate pollutants to storm water, identify solutions (BMPs), promote ownership of the problems and solutions, and integrate feedback into training and BMP implementation. A certificate to verify completion of training shall be signed by all trained personnel.

3.7 SPILL CONTROL AND REPORTING

In case of spill of hazardous, toxic, and radiological waste (HTRW), the Contractor shall stop work, contain spill, notify the COR and Safety Office, and execute spill control per the SPILL CONTROL PLAN. Spill containment, notification, clean-up, restoration, reporting, record-keeping, etc. shall be in accordance with 40 CFR 110, other applicable Federal, state, and local regulations, and to the satisfaction of the COR.

PART 6 TIMING OF CONTROLS AND ACTIVITIES.

The Contractor shall (1) sequence soil disturbing activities to preserve existing vegetation, (2) minimize area of disturbance, (3) establish storm water control devices, (4) do not disturb an area until it is necessary to proceed with field work, (5) stabilize disturbed areas as soon as practicable, (6) delay construction of infiltration measures until the end of project when upstream drainage areas are stabilized and established, (7) maintain storm water control devices until stabilized disturbed areas have achieved final stabilization. Final stabilization depicts soil disturbing activities at the site have been completed and a uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of all native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as use of rip rap, gabions, or geotextiles) have been employed. The Contractor's field and operation specific SWPPP shall (1) sequence major construction activities, (2) discuss erosion and sediment control measures, and (3) sequence temporary or permanent stabilization. It shall also include: Install silt fences or straw bale dikes around perimeter & down slope of construction site. Construct stabilized construction entrances. Install controls around contractor staging, stockpiled storage, parking, borrow, and disposal areas for on-site and off-site locations. Install inlet protections at all existing storm grates (i.e. curb inlets surface inlets, manholes, etc.) Install controls (i.e. rock berm/check/check dam, sediment log, diversion/earth dike) at outfall locations and natural drainage ways down stream from the construction site.] Demolition of structures, Grading, Cover all excavated or other soil stockpiles with soil retention blankets at the end of each work day and at the threat of precipitation. Install inlet protections at all new storm grates (i.e. curb inlets surface inlets, manholes, etc.) Backfill the utility trenches in a timely manner to minimize erosion. Monitor weather using National Weather Services reports to track conditions and alert crews to forecast rainfall or dust storm event and avoid paving, concrete saw cutting, dust or pollutant generating activities. Stabilize disturbed soil before rainfall events. Paving and other flatwork. Implement permanent stabilization.
Routinely inspect and maintain erosion and sediment structural control structures; evaluate

BMP & revise SWPPP for change conditions or field activities; assess and certify non-storm water discharges; maintain field records and training logs. Maintain (i.e. water, fertilize, mow, reseed (if necessary) the temporary and permanent stabilized area until final project acceptance. Remove all controls when the project area has achieved final stabilized and all construction is completed and accepted by the Contracting Officer. After site work completion and prior to project acceptance, the Contractor shall perform I & M of storm control conducted monthly.

3.8 INSPECTIONS

3.8.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.8.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for,pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.8.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

3.9 PERMANENT STABILIZATION

Permanent stabilization on disturbed, unpaved, and graded areas shall be initiated no more than 14 days after construction activities have ceased permanently. Final or permanent stabilization shall be in accordance with specification sections 0291 Seeding.

--End of Section -–

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality Control Plan.

B. Quality Control Organization.

C. Quality control and control of installation.

D. Tolerances.

E. References.

F. Mock-up requirements.

G. Testing and inspection services.

H. Manufacturers' field services.

I. Examination.

1.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

1.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents Subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
d. Procedures for scheduling, reviewing, certifying, and managing SECTION 1330 submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 1330 SUBMITTAL PROCEDURES
e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer shall be used.)
f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
h. Reporting procedures, including proposed reporting formats.
i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

1.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

1.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

1.3 QUALITY CONTROL ORGANIZATION

1.3.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

1.3.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a construction person with a minimum of 5 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned as System Manager but may have duties as project superintendent in addition to quality control. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

1.3.2 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

1.4 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Contracting Officer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Contracting Officer.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES

A. Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

B. ORDERING INFORMATION: The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number. The designations "AOK" and "LOK" are for administrative purposes and should not be used when ordering publications.

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1.7 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Contracting Officer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Contracting Officer.

1.8 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
   1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Owner.
   1. Laboratory: Authorized to operate in the State of Texas.
   2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Owner.

D. Reports will be submitted by independent firm to the Contracting Officer and Contractor, in accordance with Section 01330, Submittal Procedures, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Contracting Officer and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Contracting Officer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

H. Agency Responsibilities:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Contracting Officer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Contracting Officer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests required by Contracting Officer.
   7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to Architect/Engineer and to Contractor. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Conformance with Contract Documents.

J. Limits On Testing Authority:
   1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency or laboratory may not approve or accept any portion of the Work.
   3. Agency or laboratory may not assume duties of Contractor.

4. Agency or laboratory has no authority to stop the Work.

1.9 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Contracting Officer 30 days in advance of required observations. Observer subject to approval of Contracting Officer.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01330 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

F. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Provide [bonded] off-site storage and protection when site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Architect/Engineer will consider requests for Substitutions only within 30 days after date of Owner-Contractor Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Contracting Officer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

B. Cord and Plug: Furnish minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Final inspection.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting and balancing.

F. Protecting installed construction.

G. Project record documents.

H. Operation and maintenance data.

I. Manual for materials and finishes.

J. Manual for equipment and systems.

K. Spare parts and maintenance products.

L. Product warranties.

M. Maintenance service.

1.2 FINAL INSPECTION

A. Pre-Final Inspection

The Contractor shall request a pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's Quality Control Inspection Personnel shall ensure that all items on this list have been corrected before notifying the Government, so a Final Inspection with the customer can be scheduled. Any items noted on the Pre-Final Inspection shall be corrected in a timely manner. These inspections and any deficiency corrections shall be accomplished within the time stated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

B. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final inspection. Additional Government personnel including, but not limited to, those from the Base Civil Facility Engineer user groups and major commands may be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon the request of the Contractor. Notice shall be given to the Contracting officer at least seven (7) days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along withal remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will delay final payment of the contract.

1.3 FINAL CLEANING

A. Execute final cleaning prior to pre-final inspection.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Contracting Officer seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of final inspection.

B. Demonstrate Project equipment by qualified manufacturer's representative who is knowledgeable about the Project.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 TESTING, ADJUSTING AND BALANCING

A. Contractor shall employ services of independent firm to perform testing, adjusting, and balancing.

B. Independent firm will perform services specified in Section 15990.

C. Reports will be submitted by independent firm to Contracting Officer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

G. Submit documents to Contracting Officer.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Originals of warranties.

1.10 MANUAL FOR MATERIALS AND FINISHES

A. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

B. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Contracting Officer’s comments. Revise content of document sets as required prior to final submission.

C. Submit two sets of revised final volumes in final form within 10 days after final inspection.

D. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

E. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

F. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

G. Additional Requirements: As specified in individual product specification sections.

H. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.11 MANUAL FOR EQUIPMENT AND SYSTEMS

A. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

B. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Contracting Officer’s comments. Revise content of document sets as required prior to final submission.

C. Submit two sets of revised final volumes in final form within 10 days after final inspection.

D. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

E. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

F. Include color coded wiring diagrams as installed.

G. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

H. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

I. Include servicing and lubrication schedule, and list of lubricants required.

J. Include manufacturer's printed operation and maintenance instructions.

K. Include sequence of operation by controls manufacturer.

L. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

M. Include control diagrams by controls manufacturer as installed.

N. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

O. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

P. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

Q. Include test and balancing reports as specified in Section 01400.

R. Additional Requirements: As specified in individual product specification sections.

S. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.12 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Contracting Officer; obtain receipt prior to final payment.

1.13 PRODUCT WARRANTIES

A. Obtain warranties executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form and contain full information. ,

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

1.14 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections for during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Contracting Officer

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01722

MOBILIZATION AND DEMOBILIZATION
12/2002

PART 1 GENERAL

1.1 MOBILIZATION

Mobilization will be considered the transportation to the project site of the various items used for work during construction.

1.2 DEMOBILIZATION

Demobilization will be considered the transportation from the site of various items used for work during construction.

1.3 MEASUREMENT AND PAYMENT

A. All costs connected with the mobilization and demobilization of all of the Contractor's plant and equipment will be paid for at the contract lump sum price for this Item.

B. In the event the Contracting Officer considers that the amount in this Item does not bear a reasonable relation to the cost of the work in this Contract, the Contracting Officer may require the Contractor to produce cost data to justify this portion of the bid. Failure to justify such price to the satisfaction of the Contracting Officer will result in payment of actual mobilization costs, as determined by the Contracting Officer at the completion of mobilization, and actual demobilization costs, as determined by the Contracting Officer at the completion of demobilization, and payment of the remainder of this Item in the final payment under this Contract. The determination of the Contracting Officer is not subject to appeal.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 02220

DEMOLITION

10/06

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K	(2005) Containers for Recovered Fluorocarbon Refrigerants

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIAL (AASHTO)

AASHTO M 145	(1991; R 2000) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6	(1990; R 1998) Safety Requirements for Demolition Operations

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Standard for Installation Specification of Commercial Carpet

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25	(June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M	(2000) Requisitioning and Issue Procedures
MIL-STD-129 (Rev P)	Military Marking for Shipment and Storage

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev K; Change 1) Obstruction Marking and Lighting

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART M	National Emission Standard for Asbestos
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 GENERAL REQUIREMENTS

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. Remove rubbish and debris from project site; do not allow accumulations inside or outside the building. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions - G

SD-07 Certificates

Demolition Plan - G

Proposed demolition and removal procedures for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts or bills of laden, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ANSI A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the State's environmental protection agencyand the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61-SUBPART M.

Complete and submit Notification of Demolition and Renovation forms to Federal and State authorities and Contracting Officer, postmarked or delivered at least ten working days prior to commencement of work, in accordance with 40 CFR 61-SUBPART M.

1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust [and debris] [to occupied portions of the building] [on airfield pavements] and avoid the creation of a nuisance [or hazard] in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driversafety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Conditions Documentation

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a

record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document.

1.6.3 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.6.4 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.6.5 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.6.6 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.6.7 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.6.8 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.6.9 Protection of Personnel

Before, during and after the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the Contracting Officer.

1.9 REQUIRED DATA

Prepare a Demolition Plan. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use.

Coordinate with Waste Management Plan. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.10 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

1.11 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.12 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the following schedule:

PART 2 PRODUCTS

2.1 FILL MATERIAL

Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures. Fill material shall be waste products from demolition or deconstruction until all waste appropriate for this purpose is consumed.

[Fill material must conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material must be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 50 millimeter 2 inches in any dimension.

Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D]

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures on site for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse on site whenever possible.

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility

services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities [, as indicated] [uncovered by work] and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location [on the station] in accordance with instructions of the Contracting Officer.

3.1.2 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to [_____] 7 m 25 foot lengths and store in rolls off the ground.

3.1.3 Paving and Slabs

[Remove sawcut] concrete and asphaltic concrete paving and slabs [including aggregate base] [as indicated] to a depth of [150] mm inches below [existing adjacent] [new finish] grade. [Provide neat sawcuts at limits of pavement removal as indicated.]] Pavement and slabs designated to be recycled and utilized in this project shall be moved, ground and stored as directed by the Contracting Officer. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

3.1.4 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Concrete and Masonry: Completely fill holes and depressions, [caused by previous physical damage or] left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment [listed [in the [Demolition][Deconstruction] Plan][_____]] [indicated [_____]] to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified [off the [_____] center] [in the Waste Management Plan] [_____]. [Storage of removed materials on the project site is prohibited.]

3.5.2 Burning on Government Property

[Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property] [Transport combustible materials removed from demolished and deconstructed structures to the areas designated for burning. Control fires for protection of persons and property. Monitor fires continuously until the fires have burned out or have been extinguished. Comply with Federal, State and local laws regulating the building and maintaining of brush and trash fires].

3.5.3 Removal to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

3.5.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 02300

EARTHWORK

07/06

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop
AASHTO T 224	(2001) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2006) Structural Welding Code - Steel

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA P5	(2005) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A 139/A 139M	(2004) Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
ASTM A 252	(1998; R 2002) Welded and Seamless Steel Pipe Piles
ASTM C 136	(2005) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 33	(2003) Concrete Aggregates
ASTM D 1140	(2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e1) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1883	(1999) CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2434	(1968; R 2000) Permeability of Granular Soils (Constant Head)
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(2000e1) Density of Soil in Place by the Drive-Cylinder Method

ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 698	(2000ae1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety -- Safety and Health Requirements

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-203	(Rev C; Notice 2) Paper, Kraft, Untreated

1.3 PAYMENT

Payment will be made on a lump sum basis and will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

1.4 DEFINITIONS

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP. Satisfactory materials for grading comprise stones less than 8 inches, except for fill material for pavements and railroads which comprise stones less than 3 inches in any dimension.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials

classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.4.5 Overhaul - Deleted

1.4.6 Topsoil

Material suitable for topsoils obtained from offsite areas orareas indicated on the drawings is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 25 mm one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.4.7 Select Granular Material

1.4.7.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, or SP, by ASTM D 2487 where indicated. The liquid limit of such material must not exceed 30 percent when tested in accordance with ASTM D 4318. The plasticity index must not be greater than 15 percent when tested in accordance with ASTM D 4318, and not more than 25 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

1.4.7.2 California Bearing Ratio Values

Bearing Ratio: At 0.1 inch penetration, provide a bearing ratio of [_____] percent at 95 percent ASTM D 1557 maximum density as determined in accordance with ASTM D 1883 for a laboratory soaking period of not less than 4 days. [

Sieve Size	Percent Passing by Weight
2 1/2 inch	100
No. 4	40 - 85
No. 10	20 - 80
No. 40	10 - 60
No. 200	5 - 25

1.4.8 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 3 inchesor larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 3 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.9 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than [_____] when tested in accordance with ASTM D 4318.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Utilization of Excavated Materials - G
Opening of any Excavation or Borrow Pit
Shoulder Construction

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing
Borrow Site Testing

Within 24 hours of conclusion of physical tests, 5 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities.

1.6 SUBSURFACE DATA

The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at Contracting Office. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.7 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation

1.7.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.8 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Hard materials and rock will not will be encountered.

PART 2 PRODUCTS

2.1 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:]	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

2.1.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.08 mm 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.1.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.3 PIPE CASING

2.3.1 Casing Pipe

ASTM A 139/A 139M, Grade B, or ASTM A 252, Grade 2, smooth wall pipe. Match casing size to the outside diameter and wall thickness as indicated on Drawing Sheet No. C-3. Protective coating is not required on casing pipe.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inch. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm 2 inch in diameter, and other materials that would interfere with planting and maintenance operations.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest

stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.2 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 3 feet below the working level.

3.2.3 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.3 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.4 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.5 GROUND SURFACE PREPARATION

3.5.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 150 mm 6 inch before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inch, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inch and compact it as specified for the adjacent fill.

3.5.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost.

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to plus or minus 2 percent of optimum moisture.

3.6 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.7 BURIED TAPE AND DETECTION WIRE

3.7.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inch below finished grade; under pavements and slabs, bury tape 6 inch below top of subgrade.

3.7.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inch above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length. Install wires at manholes between the top of the corbel and the frame, and extend

up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.8 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed as specified in paragraph GROUND SURFACE PREPARATION. Provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.9.1 Gas Distribution

Excavate trenches to a depth that will provide a minimum 18 inch of cover in rock excavation and a minimum 24 inch of cover in other excavation.

3.9.2 Water Lines

Excavate trenches to a depth that provides a minimum cover of 2 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.9.4 Electrical Distribution System

Provide a minimum cover of 24 inch from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.10 SUBGRADE PREPARATION

3.10.1 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inch below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 15 mm 0.05 foot from the established grade and cross section.

3.10.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 90 percent of laboratory maximum density.

3.10.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inches of subgrade.

3.10.3.2 Subgrade for Shoulders

Compact subgrade for shoulders to at least [90] percentage laboratory maximum density for the [full depth of the shoulder].

3.10.3.3 Subgrade for Airfield Pavements

Compact top 600 mm 24 inch below finished pavement or top 300 mm 12 inch of subgrades, whichever is greater, to [100] [_____] percent of ASTM D 1557; compact fill and backfill material to [100] [_____] percent of ASTM D 1557.

3.11 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 30 mm 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.11.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do no disturb the finished subgrade by traffic or other operation. The Contractor is responsible for protecting and maintaining the finsihed subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.11.3 Grading Around Structures

Construct areas within 1.5 m 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.12 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 2 inch and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas or areas indicated.

3.13 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer. Determine field in-place density in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil to determine the moisture content of the soil when using this method ASTM D 3017. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D 3017; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.14.2 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per [_____] cubic meters yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.3 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.15 DISPOSITION OF SURPLUS MATERIAL

Provide surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and NED/timber as removed from Government property as directed by the Contracting Officer.

-- End of Section --

SECTION 02921

SEEDING

10/06

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 602 (1995a; R 2001) Agricultural Liming Materials

ASTM D 4427 (1992; R 2002e1) Peat Samples by Laboratory Testing

ASTM D 4972 (2001) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act

DOA SSIR 42 (1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch
Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations)

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizermay be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, and Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is [frozen,] muddy, or when air temperature exceeds [32] degrees Celsius [90] degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-approvedseed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the [Contracting Officer]

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	April - June
Season 2	September - November
Temporary Seeding	As Required

2.1.3 Seed Purity

Botanical Name	Common Name	Min. Percent Pure Seed	Min. Percent Germination and Hard Seed	Max. Percent Weed Seed
[__TBP]	[__TBP]	[__TBP]	[__TBP]	[__TBP]
[__TBP]]	[__TBP]]	[__TBP]]	[__TBP]]	[__TBP]]
[__TBP]	[__TBP]	[__TBP]	[__TBP]	[__TBP]

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
[Season 1]	[__TBP]	[__TBP]
	[__TBP]]	[__TBP]]
[Season 2]	[__TBP]	[__TBP]
	[__TBP]]	[__TBP]]

Planting Season	Variety	Percent (by Weight)
[Temporary Seeding]	[_____]	[_____]
	[_____]	[_____]

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00EARTHWORK

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50percent
Clay	4 to 12 percent
Sand	20-35percent
pH	5.5 to 7.0
Soluble Salts	600]ppm maximum

2.3 SOIL CONDITIONERS - Deleted

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

[_TBP____] percent available nitrogen
[_TBP ____] percent available phosphorus
[_TBP ____] percent available potassium
[_TBP ____] percent sulfur
[_____] percent iron

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contrain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch - Dleted

2.6 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.7.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 12 months

2.7.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.7.3 Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.7.4 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

2.7.5 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Extent of Work

Provide soil preparation, fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of on-site topsoil or existing soil] to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of [4] inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates - Omitted

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Synthetic Fertilizer [_TBP__] pounds per 1000 square feet.]]

Hydroseeding Fertilizer pounds per 1000 square feet.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be [broadcasted and drop seeding].

3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of pounds per 1000 square feet. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and ½ inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and

continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor
Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.3.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.3.4 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.3.5 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 10 to 13 gallons per 1000 square feet, using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA - Omitted

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Wood formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other affected work.

C. Form accessories.

D. Stripping forms.

1.2 RELATED REQUIREMENTS:

A. Division 2.

B. Division 3.

C. Division 4.

D. Division 5.

1.3 REFERENCES:

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 347 - Recommended Practice for Concrete Formwork.

C. PS 1 - Construction and Industrial Plywood.

1.4 SYSTEM DESCRIPTION:

A. Design, engineer and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines and dimensions.

1.5 QUALITY ASSURANCE:

A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver, store and handle materials under provisions of Division 1.

B. Deliver form materials in manufacturer's packaging with installation instructions.

C. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS:

A. Plywood: Yellow Pine or Douglas Fir species; solid one side sound, undamaged sheets with straight edges.

B. Utility grade or better; with grade stamp clearly visible.

2.3 FORMWORK ACCESSORIES:

A. Form Ties: Snap-off metal of adjustable length with waterproofing washer, and free of defects so as to leave holes not larger than one inch diameter in concrete surface.

B. Form Release Agent: Colorless material which will not stain concrete or absorb moisture.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Verify lines, levels and measurements before proceeding with formwork.

3.2 PREPARATION:

A. Hand-trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.

C. Arrange and assemble formwork to permit dismantling or stripping so that concrete is not damaged during its removal.

D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.3 FORMWORK ERECTION:

A. Verify lines, levels and centers before proceeding with formwork. Insure that dimensions agree with drawings.

B. Construct formwork, shoring and bracing to meet design and code requirements, so that resultant finished concrete conforms to required shapes, lines and dimensions.

C. Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal and to allow principal shores to remain in place where required.

D. Align joints and make watertight, to prevent leakage of mortar that disfigures appearance of concrete. Keep form joints to minimum.

E. Obtain Architect's or Engineer's review before framing openings in structural members which are not indicated on drawings.

F. Provide bracing to insure stability of formwork. Prop or strengthen previously constructed formwork that may be overstressed by construction loads.

G. Apply form release agent onto formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

H. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

I. Form slabs and beams to conform to the tolerances required or permitted by ACI 301.

3.4 INSERTS, EMBEDDED PARTS AND OPENINGS:

A. Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other sections and cooperate with trades involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on drawings or reviewed prior to installation.

D. Install concrete accessories in accordance with manufacturer's recommendations; straight, level, and plumb. Insure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

3.5 FIELD QUALITY CONTROL:

A. Inspect completed formwork, shoring, and bracing to insure that work is in accordance with formwork design and that supports, fastenings, wedges, ties, and other parts are secure.

B. Inform Architect when formwork is complete and has been cleaned, to allow for inspection. Complete review prior to placing concrete.

3.6 CLEANING:

A. Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush with water or use compressed air to remove remaining foreign matter. Insure that water and debris drain to exterior through clean-out ports.

B. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORM REMOVAL:

A. Notify Architect prior to removing formwork.

B. Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight and construction and design load which may be imposed upon it. Verify strength of concrete by compressive test results.

C. Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on structure.

D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

E. Leave forms loosely in place, against vertical surfaces, for protection until complete removal is reviewed by Architect.

F. Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction. Remove load supporting forms only when concrete has attained 75 percent of required 28 day compressive strength, provided construction is reshored.

G. Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Reinforcing steel bars, fabricated steel bars, welded wire mesh, and rod mats for cast-in-place concrete, complete with tie-wire, as shown on the drawings.

B. Support chairs, bolsters, bars supports, and spacers for reinforcing.

1.2 RELATED REQUIREMENTS:

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-In-Place Concrete.

1.3 QUALITY ASSURANCE:

A. Perform concrete reinforcing work in accordance with CRSI Manual of Standard Practice and Documents 63 and 65.

B. Conform to ACI 315 and 318.

1.4 SOURCE QUALITY CONTROL:

A. Submit certified copies of mill test reports of supplied concrete reinforcing, indicating physical and chemical analyses.

1.5 REFERENCE STANDARDS:

A. ACI 318 - Building Code Requirements for Structural Concrete.

B. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

C. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

D. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

E. Concrete Reinforcing Steel Institute - Manual of Standard Practice.

1.6 SHOP DRAWINGS:

A. Submit shop drawings in accordance with Division 1.

B. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.

PART 2 - PRODUCTS

2.1 REINFORCING:

A. Reinforcing Steel: ASTM A615 Grade 60 billet steel deformed bars.

B. Welded Steel Wire Fabric: ASTM A185 Plain type, in flat sheets.
1. Sidewalks (except those at street curb): 6” x 6” - W1.4 x W1.4 wire mesh.
2. Street Curb Sidewalks: 12" x 12" - W3 x W3 wire mesh.

2.2 ACCESSORY MATERIAL:

A. Tie Wire: Minimum 16 gage annealed type, or patented system accepted by Architect and/or Engineer.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

2.3 FABRICATION:

A. Fabricate concrete reinforcing in accordance with ACI 315, providing concrete cover specified in Section 03300.

B. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate splice locations on shop drawings.

PART 3 - EXECUTION

3.1 PLACEMENT:

A. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

B. Before placing concrete, insure reinforcing is clean, free of loose scale, dirt, and other foreign coatings which would reduce bond to concrete.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Cast-in-place concrete for foundations, structures, sidewalks, curbs, and miscellaneous cast-in-place concrete as shown on the drawings.

1.2 RELATED REQUIREMENTS:

A. Division 2.

B. Division 3.

1.3 QUALITY ASSURANCE:

A. Reference Standards: Comply with all applicable federal, state and local codes and safety regulations, Portland Cement Association standards, Texas Ready Mixed Concrete Association standards, Texas Aggregates Association standards and others referred to herein.

B. Tests and Submittals in accordance with Division 1.
   1. Mix Design and Tests: The mix design for all concrete shall be established by a testing laboratory selected by the Owner. The mix shall have been designed within six (6) months of the beginning of placement of concrete. All tests, as herein specified, shall be performed by the testing laboratory selected by the Owner. All tests shall be performed in accordance with standard ASTM procedures as follows:
      a. ASTM C172 Standard Method of Sampling Fresh Concrete.
      b. ASTM C31 Standard Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field.
      c. ASTM C143 Standard Method of Test for Slump of Portland Cement Concrete.
      d. ASTM C39 Standard Method of Test for Compressive Strength of Molded Concrete Cylinders.
   2. Access: The Architect shall have access to all places where materials are stored, proportioned or mixed.
   3. Proportions: The testing laboratory shall submit, prior to the start of concrete work, contemplated portions and the results of preliminary 7 day compression tests. Submit a separate set of proportions and test results for pumpcrete, if used.
   4. Slump test shall be made by the testing laboratory of concrete delivered to the site for each set of test cylinders.
   5. Standard test cylinders of all concrete placed in the work shall be made by the testing laboratory. One (1) set of four (4) cylinders shall be taken for each 100 cubic yards or fraction thereof poured on each day.
   6. Two (2) cylinders of each set shall be tested at 7 days and two (2) cylinders at 28 days.

7. Reports of above tests and field quality control tests: Provide copies of test reports:
   a. 1 copy to Engineer
   b. 1 copy to Architect
   c. 1 copy to Contractor
   d. 1 copy to Owner
8. Mill Reports: The Contractor shall furnish mill test reports of cement showing compliance with specifications.
9. All expenses for concrete testing shall be paid by the Owner.

C. Inspection of Reinforcing Steel and Concrete Placing: Before any concrete is placed on any particular portion of project, reinforcing steel will be observed by Architect and Engineer. Correct any errors or discrepancies before concrete is placed. Such checking and approval shall not relieve Contractor from his responsibility to comply with the Contract requirements.

1.4 REFERENCE STANDARDS:

A. ASTM C33 - Concrete Aggregates.

B. ASTM C150 - Portland Cement.

C. ACI 318 - Building Code Requirements for Structural Concrete.

D. ASTM C494 - Chemical Admixtures for Concrete.

E. ASTM C94 - Ready-Mixed Concrete.

F. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

G. ACI 305 - Recommended Practice for Hot Weather Concreting.

H. ACI 306 - Recommended Practice for Cold Weather Concreting.

I. ACI 301 - Specifications for Structural Concrete for Buildings.

1.5 SUBMITTALS:

A. Submit product data in accordance with Division 1.

B. Provide product data for specified products.

C. Submit manufacturers' instructions in accordance with Division 1.

D. Provide Shop Drawings showing construction joints.

E. Provide schedule of placing operations for review before concreting operations begin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Store materials delivered to the job and protect from foreign matter and exposure to any element which would adversely affect the properties of the material.

1.7 COORDINATION:

A. Obtain information and instructions from other trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be embedded in concrete so provisions for their work can be made without delaying the project.

B. Perform at no cost to Owner any cutting and patching made necessary by failure or delay in complying with these requirements.

PART 2 - PRODUCTS

2.1 MATERIALS - STANDARD STRUCTURAL CONCRETE:

A. Portland Cement: Type I, which shall conform to "Standard Specifications for Portland Cement" (ASTM C150) and shall be of domestic manufacture. Use only one brand of cement unless otherwise authorized by Architect.

B. Sand: Clean hard natural sand or manufactured sand, or a combination of both and conforming to ASTM C33.

C. Coarse Aggregate: Standard Concrete: Clean, hard, durable particles of close grained crushed rock, gravel or crushed gravel conforming to ASTM C33. Coarse aggregate shall range from 1/4" to 1 1/4" and shall be well graded between the size limits.

D. Water: Potable.

E. Use of Flyash is expressly prohibited where finished concrete surfaces will receive an architectural finish product such as VCT, carpet, etc. Submit mix design proportions (Flyash/Cement Ratio) to Engineer for review and approval prior to concrete placement.

2.2 MATERIALS - NON-SHRINKING CEMENT GROUT:

A. Non-Shrinking Cement Grout: For locations noted on the drawings.

B. Mixing and setting of the non-shrinking cement grout shall be as recommended by the manufacturer for the purpose intended.

2.3 MATERIALS - MISCELLANEOUS:

A. Concrete Sealers: Where scheduled by room number/name and in accordance with Section 03346.

2.4 CONCRETE STRENGTH:

A. Standard Structural Concrete: Compressive strengths of standard structural concrete shall be as shown on the drawings.

B. Non-Structural Concrete: All non-structural concrete used for drives, approaches, walks, curbs, drains, etc., shall have a strength of at least 3,000 psi after 28 days.

2.5 CONCRETE PROPORTIONING:

A. Standard Structural Concrete:
1. The testing laboratory shall establish exact proportions of constituent materials required to produce specified concrete.
2. In addition to minimum strength, the concrete shall meet the following requirements:
a. It shall have a maximum slump of 5 1/2" unless otherwise called for on drawings.
b. It must work readily into corners and angles of forms and reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on surface.
c. In general, workability should be improved by adjusting gradation of aggregates rather than by adding water.

2.6 CONCRETE MIXING:

A. Mixing Standard Structural Concrete: Use ready-mixed concrete complying with ASTM C94 and with the requirements of Contract Documents.

2.7 VAPOR BARRIER PRODUCTS:

A. Stego Wrap 15 mil Vapor Barrier by STEGO INDUSTRIES LLC, San Juan Capistrano, CA (877) 464-7834 www.stegoindustries.com

B. Barrier Bac VB350 (16 mil) Vapor Retarder by BARRIER BAC INC. Calhoun, Georgia (706) 629-4425 www.barrierbac.com

C. W.R. Meadows Premoulded Membrane with Plasmatic Core.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Do not place concrete in any unit of work until all formwork has been completely constructed, all reinforcement is secured and supported in place, all items to be built into concrete are in place, and form ties at construction joints are tightened.

B. Verify that steel and accessories are so placed as to permit proper flow of largest aggregate in concrete, before placing any concrete.

C. Before placing, clean mixing and conveying equipment, clean forms and space to be occupied by concrete, and wet forms.

D. Notify Engineer at least 48 hours before placing any concrete and obtain the Engineer's review before placing.

3.2 WEATHER CONDITIONS:

A. Protection: Unless adequate protection is provided and/or approval is obtained from the Architect, concrete shall not be placed during rain, hail, sleet, or snow.

B. Cold Weather:
   1. Comply with American Concrete Institute's ACI 306 "Recommended Practice for Cold Weather Concreting" and as herein specified.
   2. When the temperature is below 40 degrees F. or is likely to fall below 40 degrees F. during the 24 hour period after placing, equipment meeting the approval of the Architect/Engineer shall be provided for heating the concrete materials. No frozen materials or materials containing ice shall be used in cold weather. Temperatures of the separate materials, including the mixing water, when placed in the mixer shall not exceed 100 degrees F.
   3. Do not use calcium chloride, salt, and other materials containing anti-freeze agents or chemical accelerators, unless approval in writing is obtained from the Architect/Engineer.

C. Hot Weather: Comply with American Concrete Institute's ACI 305 "Recommended Practice for Hot Weather Concreting".

3.3 MOISTURE BARRIER FILM:

A. Install moisture barrier film between miscellaneous concrete slabs for equipment, etc. and the fill.

B. Lay film over the fill and onto both sides and bottom of beams.

C. Lap edges of film at least six inches. Seal with waterproof tape all joints and cuts in the film, such as where pipes extend through the film.

D. Keep pockets below film to a minimum, as approved by Engineer.

E. After reinforcing steel and other items have been installed, and immediately prior to placing concrete, repair all tears and punctures with waterproof tapes.

3.4 CONVEYING AND PLACING:

A. Structural Concrete:
   1. Keep a record open to inspection of Architect on the site of the time and date of placing concrete in each portion of the structure.
   2. Carry on concreting, once started, as a continuous operation until the section of approved size and shape is completed. Make pour cut-offs of approved detail and location.
   3. Handle concrete as rapidly as practicable from mixer to place of deposit by methods which prevent separation or loss of materials. Deposit as nearly as practicable in final position to avoid rehandling or flowing. Do not drop concrete freely where reinforcing bars will cause segregation, nor drop freely more than six feet. Deposit to maintain a plastic surface approximately horizontal. In placing thin sections of considerable heights, use openings in forms, elephant trunks, tremies, or other approved devices which permit concrete to be placed

without segregation or accumulation of hardened concrete on forms or metal reinforcement above the level of the concrete.

4. Concrete that has partially hardened shall not be deposited in the work.
5. Compact thoroughly using approved mechanical vibrators. Provide pour holes in forms to the extent necessary to insure filling or to allow necessary inspection.
6. Use mechanical vibrator at each point of dump. A stand-by vibrator in good working order shall be kept on the job until all concrete is placed.
7. Contractor shall provide runways or supports for pump concrete hose at all times during pouring. At no time shall hose be allowed to rest or drag on forms and reinforcing.
8. Set continuous expansion joint strips where edge of slab abuts vertical surfaces and where shown on the drawings. Allow for sealant application.

B. Concrete on Fill:

1. Miscellaneous concrete slabs and beams for equipment and similar uses shall be placed as indicated on the drawings.
2. Place concrete of required thickness and strike off at proper levels to receive finishes shown on drawings. Provide wood runways where wheeled equipment is used for transporting concrete.
3. Set continuous expansion joint strips where edge of slab abuts vertical surfaces and where shown on the drawings. Allow for sealant application.

3.5 CONSTRUCTION JOINTS:

A. Contractor shall submit location and details of construction joints to Engineer for review and approval.

B. Roughen and clean entire surface of joint. Clean forms and steel of drippings. Wet and slush roughed concrete surfaces with neat cement. Place new concrete before grout initially sets.

3.6 PROTECTION AND CURING:

A. Protect finished concrete surfaces from injurious action of elements and defacement of any nature during operations.

B. Keep forms sufficiently wet to prevent drying out of concrete.

C. Immediately after finishing concrete surfaces, cover with clear sheet plastic with all edges lapped six inches and fastened together with water resistant adhesive. Covering shall remain for a minimum of 7 days. NOTE: ALL HORIZONTAL CONCRETE SURFACES (FLOOR AREAS) SHALL BE WET CURED.

D. Protect slabs and exposed corners of concrete from traffic or damage.

3.7 PATCHING AND CLEANING:

A. Immediately after forms are removed, remove projecting fins, bolts, form ties, nails, etc., that are not necessary for the work. Patch by filling all voids, chipped areas, etc. Repaired surfaces shall match appearance of unpatched work.

3.8 FINISHING:

A. In accordance with Section 03346.

3.9 MISCELLANEOUS ITEMS OF CONCRETE:

A. Equipment Foundations: Provide concrete bases for electrical and mechanical equipment as shown on the drawings. Anchor bolts shall be provided and set by the equipment contractor.

B. Sidewalks: In accordance with Division 2, unless otherwise indicated, place 1/2" prefabricated compressible type expansion joints at curbs, at juncture of walks and buildings and/or other vertical surfaces, and not over 30 feet apart in run of walk. Slope surface 1/4" per foot, or crown as required. Provide false joint markings spaced equal to the width of the walk unless otherwise shown on drawings. The outer edges of joints shall be rounded with approved tools to a radius of 1/4".

C. Curbs: In accordance with Division 2, construct new concrete curbs, as directed, to conform to local laws and ordinances. Trowel finish smooth with corners rounded. Install 1/2" prefabricated compressible type expansion joints in all curbs as shown on drawings but not to exceed spacing of 30'-0" on center.

3.10 CLEAN-UP:

A. Clean-up all concrete and cement work upon completion of this portion of the work, except that curing blankets/visqueen shall remain for 7 days.

END OF SECTION

SECTION 03346

FINISHING CONCRETE SURFACES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Finish all new concrete surfaces.

B. Apply concrete sealers where scheduled by room number/name.

C. Wet cure finished surfaces in accordance with Section 03300.

1.2 RELATED WORK:

A. Division 2.

B. Division 3.

1.3 REFERENCE STANDARDS:

A. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

1.4 DELIVERY OF MATERIALS:

A. Furnish concrete hardeners, sealers, and other admixtures in manufacturer's packaging complete with application instructions.

PART 2 - PRODUCTS

2.1 SEALER FOR CONCRETE FLOORS:

A. Master Builders or approved equal. Submit manufacturer's literature for review and approval.

PART 3 - EXECUTION

3.1 CONCRETE FINISHING:

A. Finish concrete surfaces in accordance with ACI 302 and ACI 304.

B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration.

C. Maintain surface flatness, with maximum variation of 1/8 inch in 10 feet.

D. Steel trowel horizontal surfaces which will be left exposed, unless another surface is noted, scheduled or specified.

E. Concrete Curbs: Construct to conform to local ordinances. Trowel finish smooth all exposed surfaces. Provide 3/4 inch radius on outside corner and 1/8 inch radius at edge toward sidewalk, except where "rolling" edge is to be provided.

F. Sidewalks: Shall be floated and troweled to a uniform smooth surface, then finished with a camel hair brush or wood float to a gritty texture.

G. Monolithic Concrete Floors, whether to remain exposed or to receive another floor material:
   1. Screed the floors to a plane surface, level or sloped as indicated, free from excess water and laitance, using a special tool to tamp the surface and bring the fines to the surface. Float with a wood float to the level of preset screeds.
   2. Trowel by machine or hand trowels to a smooth, finished surface, without dusting of cement.
   3. Give a final burnishing coat by hand with a steel trowel.
   4. Typically, surfaces shall be true to established levels within a tolerance of 1/4 inch in the length of a ten-foot straight edge when straight edge is placed in any direction.

H. Rubbed Concrete: Exposed concrete surfaces shall be rubbed with Carborundum stone and water. The rubbing shall be continued sufficiently to bring the surface to a paste, a smooth dense surface without pits, voids or irregularities. The use of cement to form a surface paste will not be permitted. The surfaces shall be left with a clean, neat, and uniform appearance and shall be uniform in color.

I. Sealers: Apply sealer where scheduled by room number/name, in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 04065

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 04810 - Unit Masonry Assemblies: Installation of mortar and grout.
2. Section 08115 - Standard Steel Frames: Grouting steel door frames.

1.2 REFERENCES

A. ASTM International:
1. ASTM C91 - Standard Specification for Masonry Cement.
2. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
5. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
6. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
7. ASTM C476 - Standard Specification for Grout for Masonry.
8. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
9. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
10. ASTM C1329 - Standard Specification for Mortar Cement.
11. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

B. The Masonry Society:
1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Samples: Submit two samples of mortar, illustrating mortar color and color range.

C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:
   1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
   2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

E. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

B. Maintain one copy of each document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Hot and Cold Weather Requirements: TMS MSJC Specification.

PART 2 PRODUCTS

2.1 MORTAR AND MASONRY GROUT

A. Manufacturers:
   1. Blue Circle Cement
   2. Citadel Cement
   3. CTS Cement Manufacturing Co.
   4. Lehigh Portland Cement
   5. Medusa Cement Co.
   6. The Quikrete Companies
   7. Substitutions: Section 01600 - Product Requirements

2.2 COMPONENTS

A. Portland Cement: ASTM C150, Type I, white color.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Aggregate: ASTM C404, maximum 3/8 inch.

E. Water: Clean and potable.

F. Mortar Color: As selected to match existing building.

G. Bonding Agent: Latex type.

H. Calcium chloride is not permitted.

2.3 ADMIXTURES

A. Plasticizer: Water reducing type if recommended by Testing Laboaratory.

2.4 MIXES

A. Mortar Mixes:
   1. Mortar For Non-Structural Masonry: ASTM C270, Type N using Property specification.
   2. Mortar For Non-Structural Masonry: ASTM C270, Type S using Property specification.

B. Mortar Mixing:
   1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
   2. Achieve uniformly damp sand immediately before mixing process.
   3. Add mortar color to achieve uniformity of mix and coloration.
   4. Re-temper only within two hours of mixing.

C. Grout Mixes:
   1. Bond Beams, Lintels, Fill Cores at Jambs: 3000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 fine grout.

D. Grout Mixing:
   1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
   2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Request inspection of spaces to be grouted.

3.2 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

3.3 INSTALLATION

A. Install mortar and grout in accordance with ASTM C270.

B. Install grout to requirements of the specific masonry section.

C. Work grout into masonry cores and cavities to eliminate voids.

D. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

E. Do not displace reinforcement while placing grout.

F. Remove excess mortar from grout spaces.

3.4 FIELD QUALITY CONTROL

A. Establishing Mortar Mix: In accordance with ASTM C270.

END OF SECTION

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes brick; concrete masonry units; reinforcement, anchorage, and accessories.

B. Related Sections:
1. Section 04065 - Masonry Mortar and Grout: Mortar and grout.
2. Section 05500 - Metal Fabrications: Product requirements for loose steel lintels for placement by this section.
3. Section 07110 - Dampproofing: Dampproofing masonry surfaces.
4. Section 07212 - Board Insulation: Insulation for cavity spaces.
5. Section 07600 - Sheet Metal Flashing and Trim: Product requirements for flashings for placement by this section.
6. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.
7. Section 08115 – Standard Steel Frames: Product requirements for frame anchors for placement by this section.

1.2 REFERENCES

A. ASTM International:
1. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
2. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
4. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
5. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
6. ASTM C1405 -
7. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
8. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.

B. The Masonry Society:
1. TMS MSJC - Building Code for Masonry Structures ACI 530/ASCE 5/TMS 402, Specification for Masonry Structures ACI 530.1/ASCE 6/TMS 602 and Commentaries.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Product Data: Submit data for glazed face brick masonry units and fabricated wire reinforcement; wall ties; anchors and other accessories.

C. Samples: Submit four samples of glazed face brick and face brick units to illustrate color, texture and extremes of color range.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years of documented satisfactory experience.

1.6 MOCKUP

A. Section 01400 - Quality Requirements: Mockup requirements.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum two weeks prior to commencing any work of this section. The meeting shall be combined with the Pre-installation meeting requirements of Section 07110 and 08800.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Hot and Cold Weather Requirements: TMS MSJC Specification.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate masonry work with precast architectural concrete units, installation of window and door anchors.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Hollow Non-Load Bearing Concrete Masonry Units (CMU): ASTM C129, Type I - Moisture Controlled; light weight.

B. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight.

C. Concrete Masonry Unit Size and Shape: Nominal modular size of 4 x 8 x 16 inches, 8 x 8 x 16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and bullnosed corners.

2.2 ACCESSORIES

A. Single Wythe Joint Reinforcement: Truss type; cold drawn steel wire conforming to ASTM A82, hot dip galvanized to ASTM A153, Class B2 after fabrication, 3/16 inch side rods with 9 gage cross rods. Manufacturer: Hohmann & Barnard, Inc., Model 120.

B. Reinforcing Steel: specified in Section 03200.Strap Anchors: Bent steel shape, 1 1/2 inch x required length inch size x 3/16 inch thick, hot dip galvanized to ASTM A153/A153M, B2 finish.

C. Mortar and Grout: As specified in Section 04065.

D. Preformed Control Joints: Neoprene material. Furnish with corner and tee accessories, cement fused joints.

E. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding; 5/8 inch wide x by maximum lengths.

F. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

G. Weeps: Full head joints.

H. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Placing And Bonding:
1. Lay hollow masonry units with face shell bedding on head and bed joints.
2. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
3. Remove excess mortar as work progresses.
4. Interlock external corners.
5. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
6. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
7. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, cavity insulation adhesive is applied, or bitumen dampproofing is applied.
8. Isolate masonry from vertical structural framing members with movement joint as indicated on Drawings.

9. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler with joint as indicated on drawings.

E. Joint Reinforcement And Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Reinforce joint corners and intersections with strap anchors 16 inches oc.

F. Lintels:
1. Install reinforced unit masonry lintels over openings where steel lintels are not scheduled or indicated.
2. Do not splice reinforcing bars.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. Allow masonry lintels to attain specified strength before removing temporary supports.
6. Maintain minimum 8 inch bearing on each side of opening.

G. Grouted Components:
1. Reinforce bond beam as indicated on drawings.
2. Lap splices 24 bar diameters.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. Fill masonry cores with grout for minimum 12 inches both sides of opening.

H. Control And Expansion Joints:
1. Do not continue horizontal joint reinforcement through control and expansion joints.
2. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
3. Size control joint in accordance with Section 07900 for sealant performance.
4. Form expansion joint by omitting mortar and cutting unit to form open space.

I. Built-In Work:
1. As work progresses, install built-in steel door and fabricated metal frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.

3. Bed anchors of steel door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

J. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and electrical boxes. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.5 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Supply and install all Structural Steel work as indicated on the drawings and specified herein.

1.2 RELATED REQUIREMENTS:

A. Section 05210 - Steel Joists.

B. Section 05310 - Metal Deck.

C. Section 05500 - Metal Fabrications.

1.3 REQUIREMENTS OF REGULATORY AGENCIES:

A. Comply with federal and state codes and regulations for performance of the work of this Section including erection safety regulations.

1.4 REFERENCE STANDARDS:

A. Except where provision of these Specifications are more stringent, work of this Section shall comply with all applicable provisions of the latest editions of the following standards. When in conflict, the more stringent requirements shall apply.

B. AISC Specification is defined as AISC “Specification for Structural Steel Buildings”, Ninth Edition, and the AISC “Code of Standard Practice for Steel Buildings and Bridges”, Ninth Edition.

C. AWS Building Code shall mean AWS D1.1 "Structural Welding Code – Steel”.

D. Specification for Structural Joints shall mean "Specification for Structural Joints Using ASTM A325 or A490 Bolts” approved by the Research Council on Riveted and Bolted Joints of the Engineering Foundation.

1.5 QUALIFICATIONS:

A. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

B. Provide certification that welders employed in the work shall have satisfactorily passed AWS qualification tests within 12 months prior to the time of welding in the erection period.

C. If re-certification of welders is required, re-testing shall be the Contractor's responsibility.

1.6 SUBMITTALS:

A. Shop Drawings:
1. Submit connection details for review and approval prior to preparation of other shop and erection drawings. Provide manufacturer's specifications and test reports for high-strength bolts.
2. Submit six sets of shop drawings indicating all shop and erection details, including cuts, copes, connections, holes and welds.
3. All welds, both shop and field, shall be indicated by AWS welding symbols, showing size, length and type.

B. Mill Reports: The Contractor shall furnish three certified copies of all mill reports covering the chemical and physical properties of the steel used.

C. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including the sequence of erection, equipment to be employed, and methods to accomplish temporary staying and bracing.

1.7 PRODUCT HANDLING:

A. Delivery of Materials to be Installed under other Sections:
1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete and masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.

B. Storage of Materials:
1. Structural steel members that are stored at the project site shall be above ground on platforms, skids, or other supports.
2. Steel shall be protected from corrosion.
3. Other materials shall be stored in a weather-tight and dry place, until needed for use in the work.
4. Packaged materials shall be stored in their original unbroken package or container.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. All structural steel shapes, bars, plates and other structural steel shall be new and of basic open hearth process steel of domestic manufacture conforming to all applicable requirements of ASTM A36.

B. Structural steel tubing shall be of domestic manufacture conforming to all applicable requirements of ASTM A500, Grade B.

C. Threaded Fasteners: Standard bolts: ASTM A325-X, in accordance with Part 4, Table I or Table III of AISC Manual, complete with nuts and standard or beveled washers as required. Standard nuts: ASTM A563. Standard and beveled washers: ASTM F436.

D. Anchor Bolts: Conform to Section 1.3 of ASTM A307.

E. Shop Paint Primer: Zinc chromate primer.

F. Non-Shrink Grout: Pre-mixed, factory packaged grouting compound. Submit product data and manufacturer's literature for review and approval.

2.2 FABRICATION:

A. Fabricate structural steel in accordance with the applicable city Building Code and AISC Specification for Structural Steel Buildings with the modifications and additional requirements specified in this Section.
   1. Where a conflict occurs between the standards specified above, the more stringent shall govern.
   2. Structural material shall be fabricated and assembled in the shop to the greatest extent possible.
   3. Mark and match-mark all materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling.

B. Shop connections shall be welded except where shown to be bolted.

C. Welded Construction:
   1. Welded construction shall conform to the AISC Specification for Structural Steel Buildings.
   2. Welding process shall be limited to one or a combination of the following: Gas metal-arc, flux cored arc, electroslag or electrogas.

D. Connections shall be made to conform to the AISC Specification for Structural Steel Buildings.

E. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members to permit connecting the work of other trades. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling or reaming operations shall be removed with a tool making a 1/16 inch bevel.

F. Column bottoms shall be milled and welded to bases.

G. Shop Painting:
   1. Shop paint all steelwork except contact surfaces which are to be welded, high-strength bolted or riveted. Coat all joints and crevices thoroughly. Paint any surfaces concealed or inaccessible after assembly, prior to assembly.
   2. Steelwork to be painted shall receive the following shop paint system:
      a. Surface Preparation: Remove all mill scale, rust, dirt, grease and other harmful materials prior to coating, and prepare surface per SSPC SP3, Power Tool Cleaning.

b. Visual Standard of Cleanness: SSPC Visual Pictorial Standards B St3, C St3 and D St3.
c. Pre-treatment: None required.
d. Paint Application: SSPC PA 1, as soon as possible after cleaning.
e. Paint: Zinc chromate primer.
f. Number of Coats: One.
g. Dry Film Thickness: Not less than 2.0 mils.
h. Promptly repair any damaged coating with primer.

PART 3 - EXECUTION

3.1 PRE-ERECTION INSPECTION:

A. Immediately report to Architect any errors in shop fabrication or deformation resulting from handling and transportation that prevents proper assembly and fitting of parts. Obtain approval of method or correction. Approved corrections shall be made at no additional cost to the Owner.

B. Examine the areas and conditions under which structural steel work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 ERECTION:

A. Erect structural steel in accordance with the Building Code of local jurisdiction and AISC Specifications with modifications and additional requirements of this Section: Where a conflict occurs between the standards specified, the more stringent shall govern.

B. Connections shall be inspected by the testing laboratory.

C. Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

D. Provide any temporary shoring and additional bracing of steel framing necessary to adequately and safely support any or all loads imposed on structure during construction. As erection progresses, the work shall be securely fastened to sufficiently resist all dead load, wind, and erection stresses. Remove temporary members and connections when permanent members are in place and final connections are made.

E. Erection Tolerances: Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 in 500.

3.3 FIELD ASSEMBLY:

A. Structural steel frames shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.

B. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.

C. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled.

D. Splices shall be permitted only where indicated.

E. Erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.

F. Driftpins may be used only to bring together the several parts and shall not be used in such manner as to distort or damage the metal.

G. Gas Cutting: The use of a gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. The use of a gas-cutting torch will be permitted only on minor members, when the member is not under stress, and only after the approval of the Engineer has been obtained.

3.4 TEMPORARY PROTECTION:

A. Provide two layers of corrugated cardboard wrapped around steel tube columns and other structural shapes that are adjacent to masonry surfaces in order to prevent any bonding of steel to masonry. Secure cardboard by use of light gage wire or similar method of fastening.

3.5 FIELD TOUCH-UP PAINTING:

A. After the erection of structural steel, and before the erection of masonry, touch-up paint field welds, bolt heads, nuts and abrasions in the shop paint coating with the same paint used for the shop painting.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items.
   1. Lintels.
   2. Channel door frames.
   3. Structural supports for miscellaneous attachments.
   4. Anchor bolts for sill plates.

B. Related Sections:
   1. Section 05120 - Structural Steel: Structural steel anchor bolts.
   2. Section 05200 - Steel Joists: Structural joist bearing plates, including anchorage.
   3. Section 09900 - Paints and Coatings: Field applied paint finish.
   4. Section 03300 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   5. Section 04810 - Unit Masonry Assemblies: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in masonry.

1.2 REFERENCES

A. Aluminum Association:
   1. AA DAF-45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association:
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

C. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. ASTM A297/A297M - Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application.

7. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
8. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
9. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
10. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
11. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

D. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

E. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.

F. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC SP 1 - Solvent Cleaning.
3. SSPC SP 10 - Near-White Blast Cleaning.
4. SSPC Paint 15 - Steel Joist Shop Paint.
5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.5 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500, Grade B.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40.

E. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153/A153M for galvanized components.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic zinc rich.

2.2 LINTELS

A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.
   1. Exterior Locations: Galvanized. Prime paint, two coats.
   2. Interior Locations: Prime paint, two coats.

2.3 STRUCTURAL SUPPORTS

A. Other Structural Supports: Steel sections, shape and size as indicated on Drawings required to support applied loads with maximum deflection of 1/240 of the span; prime paint, two coats (interior); galvanize (exterior).

2.4 ANCHOR BOLTS

A. Anchor Bolts: ASTM A307; 3/4 inch steel bolt, standard J-hook, with nut and washer; unfinished.

2.5 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.6 FACTORY APPLIED FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with one coat two coats except where galvanizing is specified.

D. Galvanized Structural Steel Members: Galvanize after fabrication to ASTM A123. Furnish minimum 1.25 oz/sq ft galvanized coating.

E. Galvanized Non-structural Items: Galvanized after fabrication to ASTM A123. Furnish minimum 1.25 oz/sq ft galvanized coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Architect prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05810

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes expansion joint assemblies for interior floor, wall and ceiling surfaces.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of joint assembly frames in formwork.
2. Section 03300 - Cast-in-Place Concrete: Expansion and contraction joints in junction of concrete slab-on-grade and perimeter walls.
3. Section 04810 - Unit Masonry Assemblies: Execution requirements for placement of joint assembly frames specified in this section in concrete masonry.
4. Section 07900 - Joint Sealers: Expansion and control joint finishing utilizing sealant and bond breaker.

1.2 REFERENCES

A. ASTM International:
1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
3. ASTM B455 - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate joint and splice locations, miters, layout of work, affected adjacent construction, and anchorage locations.

C. Product Data: Submit joint assembly profiles, profile dimensions, anchorage devices, available colors and finish.

D. Samples: Submit two samples 6 inch long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Submit rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 FIELD MEASUREMENTS

A. Verify field measurements are as instructed by manufacturer.

PART 2 PRODUCTS

2.1 EXPANSION JOINT ASSEMBLIES

A. Manufacturers:
1. Architectural Art Manufacturing, Inc.
2. Balco/Metalines.
3. Pawling Corp.
4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B221, 6063-T5 alloy, 6061-T6 extrusions.

B. Resilient Filler: Neoprene, exhibiting Shore A hardness of 40 - 50 Durometer.

C. Threaded Fasteners: Aluminum or Stainless steel.

2.3 FABRICATION

A. Joint Covers: Aluminum cover plate, aluminum frame construction, retainers with resilient neoprene filler strip, designed to permit plus or minus 50 percent joint movement with full recovery, flush and recess mounted.

B. Back paint components in contact with cementitious materials.

C. Galvanize embedded ferrous metal anchors and fastening devices.

D. Shop assemble components and package with anchors and fittings.

E. Furnish joint components in single length wherever practical. Minimize site splicing.

2.4 FACTORY FINISHING

A. Floors: Mill finish.

B. Walls and Ceilings: Clear anodized.

C. Resilient Filler Exposed to View: Gray.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Provide anchoring devices for installation and embedding.

B. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Align work plumb and level, flush with adjacent surfaces.

B. Rigidly anchor to substrate to prevent misalignment.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Do not permit traffic over unprotected floor joint surfaces.

C. Install removable strippable coating to protect finish surface.

3.5 SCHEDULES

A.	Floor to Floor:	C10-11-41
B.	Floor to Wall:	C10-32-41
C.	Ceiling to Ceiling:	J10-71-44
D.	Ceiling to Wall:	J10-72-44
E.	Wall to Wall:	H10-51-14
F.	Wall to Wall (Inside Corner)	H10-61-14

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes perimeter nailers; blocking in wall and openings; wood furring and grounds; and preservative treatment of wood.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

C. National Institute of Standards and Technology:
   1. NIST PS 20 - American Softwood Lumber Standard.

D. The Redwood Inspection Service:
   1. RIS - Standard Specifications for Grades of California Redwood Lumber.

E. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.

F. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: Certified by NIST PS 20.

2. Plywood Grading Agency: Certified by APA/EWA.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: SPIB; WCLIB.

B. Exterior Plywood: APA/EWA ,Grade B on exposed face and Grade C on concealed faces.

C. Interior Plywood(Where concealed by other work): APA/EWA, Grade C-D plugged.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA C1, Wolman salts in accordance with LP02 for normal exposure.

B. Fire Retardant Treatment: Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25/450.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Space framing and furring 16 inches oc.

D. Install telephone and electrical panel back boards with plywood material where required. Size back boards 12 inches beyond size of electrical and telephone panel.

3.4 SCHEDULES

A. Wood Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

B. Misc. Wood Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes finish carpentry items, as indicated or implied on the Drawings, other than shop fabricated Work, with hardware and attachment accessories.

B. Related Sections:
1. Section 06100 – Rough Carpentry: Grounds and support framing.
2. Section 08212 - Flush Wood Doors.
3. Section 09900 - Paints and Coatings: Painting and finishing of finish carpentry items.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.
2. ANSI A156.9 - Cabinet Hardware.
3. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. APA-The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Architectural Woodwork Institute:
1. AWI - Quality Standards Illustrated.

E. American Wood-Preservers' Association:
1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.

F. Federal Specification Unit:
1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

G. Hardwood Plywood and Veneer Association:
1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

H. National Institute of Standards and Technology:
1. NIST PS 20 - American Softwood Lumber Standard.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect work from moisture damage.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 SEQUENCING

A. Section 01100 - Summary: Work sequence.

B. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Softwood Lumber: AWI Grade, Custom; maximum moisture content of 6-8 percent; and the following:
   1. Species of Wood: Yellow pine.
   2. Cut or Slicing of Wood: Smooth sawn.

B. Hardwood Lumber: AWI Grade, Custom; maximum moisture content of 6-8 percent; and the following:
   1. Species of Wood: Natural Birch, transparent finish; Open or closed cell grain species suitable for opaque finish.
   2. Cut or Slicing of Wood: Plain sliced.
   3. Matching of Individual Leaves to Each Other: book matching.

C. Softwood Plywood: AWI Grade AA veneer; Custom; veneer core; type of glue recommended for application; and the following:
   1. Species of Veneer: Fir face.

D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, standard grade, 1/4 inch thick, smooth one side.

2.2 ACCESSORIES

A. Fasteners: Of size and type to suit application; galvanized for exterior, high humidity, and treated locations and plain finish in exposed locations.

B. Bolts, Nuts, Washers, Lags and Screws: Size and type to suit application/non-corrosive for high humidity, and treated wood locations; plain finish at other interior locations.

C. Concealed Joint Fasteners: Threaded steel.

D. Glass: Type as specified in Section 08800.

E. Primer: Alkyd primer sealer type.

F. Wood Filler: Solvent base, tinted to match surface finish color.

G. Wood Treatment:
   1. Fire Retardant (FR-S Type): Chemically treated and pressure impregnated; capable of providing maximum flame spread/smoke development rating of 25 in accordance with ASTM E84.
   2. Wood Preservative by Pressure Treatment (PT Type): AWPA Treatment C1 using preservative with 0.25 lbs/cu ft retention.
   3. Shop pressure treated; treatment to wood materials requiring fire rating preservatives to concealed wood blocking.
   4. Provide identification on fire retardant treated material.
   5. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
   6. Redry wood after pressure treatment to maximum 6 percent moisture content.

2.3 FABRICATION

A. Fabricate to AWI Custom standards.

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. Fit exposed sheet material edges with matching hardwood edging. Use one piece for full length only.

D. Shop prepare and identify components for book match grain matching during site erection.

E. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of backing and support framing.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 EXISTING WORK

A. Modify and extend existing finish carpentry installations using materials and methods as specified.

3.3 INSTALLATION

A. Install work in accordance with AWI Custom quality standard.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Site Applied Wood Treatment:
   1. Apply preservative treatment.
   2. Brush apply one coats of preservative treatment on wood in contact with cementitious materials.
   3. Allow preservative to dry prior to erecting members.

E. Preparation For Site Finishing:
   1. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation from Indicated Position: 1/16 inch.

C. Maximum Offset from Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07110

DAMPPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cold applied asphalt bituminous dampproofing; and adhesive for insulation.

B. Related Sections:
1. Section 03300 - Cast-In-Place Concrete: Concrete Surfaces.
2. Section 04810 - Unit Masonry Assemblies: Masonry concrete surfaces.
3. Section 09260 – Gypsum Board Assemblies: Wall sheathing at masonry veneer.

1.2 REFERENCES

A. ASTM International:
1. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

B. National Roofing Contractors Association:
1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until membrane has cured.

PART 2 PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

A. Manufacturers:

1. Degussa; Hydrocide 700B sprayed applied.
2. Karnak Corp. #220 sprayed applied.
3. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Cold Asphaltic Materials:
   1. Emulsified Asphalt: ASTM D1227 (non-asbestos).
   2. Asphalt Primer: ASTM D41, compatible with substrate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer or applicator.

D. Do not apply dampproofing to surfaces requiring membrane flashing.

E. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.3 INSTALLATION

A. Prime surfaces in accordance with manufacturer’s instructions.

B. Apply cold bitumen by spray application.

C. Apply bitumen at temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish blowing temperature for four hours.

D. Apply bitumen in two coats, continuous and uniform, at rate to achieve a dry film thickness of 30 mils. (.30 inch) minimum.

E. Apply to the following surfaces: Above grade concrete masonry backup wall, concrete beams, concrete columns and over entire surface of gypsum board sheathing.

F. Place 6 inch wide membrane flashing (specified in Section 04810) at perimeter of wall openings and over masonry control joints. Extend membrane full height and length of joints. Do not apply dampproofing to surfaces requiring membrane flashing.

G. Seal items Projecting through dampproofing surface with mastic. Seal watertight.

H. Immediately backfill against dampproofing to protect from damage.

I. Adhere protection board to substrate with mastic. Scribe and cut boards around Projections, penetrations, and interruptions.

3.4 SCHEDULES

A. CMU Back Up Wall: Two coatings of asphalt dampproofing to achieve specified thickness.

B. Gypsum Board Sheathing (Stucco substrate): Two coatings of asphalt dampproofing to achieve specified thickness.

END OF SECTION

SECTION 07213

BATT INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes batt insulation in exterior wall roof construction; and batt insulation for filling crevices in exterior wall and roof.

B. Related Sections:
1. Section 06100 - Rough Carpentry
2. Section 07220 – Roof Insulation.
3. Section 09260 – Gypsum Board Assemblies
4. .

1.2 REFERENCES

A. ASTM International:
1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, limitations.

1.4 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with other trades which abut, adjoin, or are affected by Work under this section.

PART 2 PRODUCTS

2.1 BATT INSULATION

A. Manufacturers:
1. Johns Manville
2. CertainTeed Insulation.
3. Owens Corning Fiberglas.
4. U.S. Gypsum Co. Thermafiber LLC.
5. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Batt Insulation: ASTM C991 Type II; glass fiber blanket; conforming to the following:
1. Johns Manville Model Microlite “L”
2. Thermal Resistance: R-19.
3. Roll Size: 48 inch 50 foot lengths.
4. Facing: Unfaced.
5. Flame/Smoke Properties: 25/50 in accordance with ASTM E84.

B. Sheet Vapor Retarder: White polypropylene film reinforced with glass fiber reinforcing yarn and metalized polyester film laminated with flame retardant adhesive; 0.007 inch thick.
1. Manufacturer: Johns Manville Model VR-One.

C. Staples: Type and size to suit application.

D. Tape: Type as recommended by insulation manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. Install in over steel roof purlins without gaps or voids.

B. Staple facing flanges in place at maximum 6 inches oc. Retain in place with wire mesh secured to framing members.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. Tape in place.

G. Metal Framing: Place vapor retarder on warm-in-winter side of insulation; lap and seal sheet retarder joints over member face.

END OF SECTION

SECTION 07468

METAL SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes preformed metal siding system for walls with related flashings and accessory components.
   1. Provide dampproofing over concrete masonry back-up walls.

B. Related Sections:
   1. Section 04810: Unit Masonry Assemblies: Back up wall system.
   2. Section 07110 - Dampproofing.
   3. Section 07430 - Composite Panels.
   4. Section 07613 – Manufactured Sheet Metal Roofing.

1.2 REFERENCES

A. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:
   1. ASTM A606 - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
   2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   5. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

1.3 SYSTEM DESCRIPTION

A. System: Preformed and prefinished metal siding system of vertical profile; site assembled.

1.4 PERFORMANCE REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.

B. Maximum Allowable Deflection of Panel: 1/180 of span.

C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.

C. Product Data: Submit data on panels.

D. Design Data: Submit design calculations.

E. Samples: Submit two samples of siding, 12 x 12 inch in size illustrating finish color, sheen, and texture.

F. Manufacturer’s Installation Instructions: Submit special procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

C. Design Metal Siding under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Project Requirements: Product storage and handling requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials capable of causing discoloration or staining.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of doors and adjacent components or materials.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for metal siding.

PART 2 PRODUCTS

2.1 MANUFACTURED METAL SIDING

A. Manufacturers:
1. MBCI Model PBR.
2. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Exterior Panel and Other Sheet Materials: Minimum 24 gage thick precoated steel stock; profile as indicated on Drawings; 36 inches wide panel; lapped edges, tape sealed.
1. Precoated Galvanized Steel: ASTM A755/A755M; ASTM A924/A924M, Grade D, Coating Designation G90 (Z275); shop precoated with fluorocarbon coating. Exposed Exterior Surfaces: Color to match existing building panels.

B. Miscellaneous Sheet Materials: Minimum 24 gage thick steel stock;
1. Galvanized Steel: ASTM A924/A924M, Grade D, Coating Designation G90 (Z275). Precoated Surfaces: Color as selected to match existing.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles. Mitered internal corners to be back braced with 22 gage thick pre-coated sheet stock to maintain continuity of profile.

D. Trim, Closure Pieces, Caps, and Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

E. Anchors: Galvanized steel.

2.3 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; color as selected.

B. Sealants: Specified in Section 07900.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers; fastener cap same color as exterior panel. Exposed fasteners same finish as panel system.

D. Power Actuated Fasteners: Steel, hot dip galvanized; with soft neoprene washers, fastener cap same color as exterior panel.

E. Field Touch-up Paint: As recommended by panel manufacturer.

F. Bituminous Paint: Asphalt base.

G. Building Paper: ASTM D226, 15 pound unperforated asphalt felt.

2.4 FABRICATION

A. Panel Profile: Manufacturer’s standard profile for specified system.

B. Fabricate corners in one continuous piece with minimum 18 inch returns.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify building framing members are ready to receive panel system.

3.2 INSTALLATION

A. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

B. Fasten siding to structural supports; aligned, level, and plumb.

C. Locate joints over supports. Lap panel ends minimum 2 inches.

D. Use concealed fasteners unless otherwise approved by Architect/Engineer.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Offset From Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

C. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.4 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Remove site cuttings from finish surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07600
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Flashing and sheet metal shall be of the materials indicated and installed to provide a permanent watertight condition. Work includes removal of existing metal flashings with replacement of the existing metal where indicated so as to integrate into the new roof system.

B. Sheet metal includes prefinished (Kynar 500) metals, galvanized metals, fasteners and associated accessories.

C. All sheet metal work shall be covered under the warranty designated in Section 07510.

1.02 RELATED DOCUMENTS

Uniform General Conditions, Supplementary General Conditions, Forms, Specification Section found in Division 1 through Division 16 and all Drawings apply to Work specified in this Section.

1.03 RELATED SECTIONS

A. Section 07613 – Manufactured Sheet Metal Roofing

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop drawings shall be required as part of the work. Shop drawings shall conform to the following requirements.
   1. Shop drawings shall be professionally produced in Autocad 2007 format and submitted in CD format and printed form.
   2. Shop drawings shall include roof plans indicating locations of all sheet metal components.
   3. Shop drawings shall be produced to a recognized scale. Roof plans shall be produced at 1/8" per foot scale. Details shall be produced at 3" per foot scale.
   4. The Architect=s drawings may not be reproduced or used in any manner except for general guidance for the shop drawing requirement.
   5. Shop drawing details shall identify all components including type and gauge of metals; method of jointing; each type of fastener and spacings; and general reference to adjacent components.

C. Include each sheet metal type, color chart, fasteners, and sealants.

1.05 QUALITY ASSURANCE

A. Installation shall comply with current SMACNA Architectural Sheet Metal Manual as applicable.

B. All sheet metal fabrication and installation shall be performed only by qualified sheet metal mechanics familiar and competent in their trade.

1.06 WARRANTY

All sheet metal work shall be covered under the warranty included in Section 07510. Sheet metal work shall be warranted against defects in materials and installation and to be watertight for a period of not less than two (2) years from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized steel shall be lock forming quality G90 in following gauges and meeting ASTM A-525. Fasteners for these metals must be hot-dipped galvanized or stainless steel as applicable. Unless other indicated below or on the Drawings all metals shall be 24-gauge.
   1. Hook Strip: Minimum 22-gauge. Nail at 8" on center with roofing nails.
   2. Vent Flashings: All joints shall be fully soldered.
   3. Termination Bar: 12-gauge x 1" hot-dipped galvanized bar stock fastened with specified drive pins spaced at 12" on center.
   4. Equipment Curb Caps: All joints fully soldered. Attach to curbs per Drawings.
   5. Downspout Boots: 12-gauge with continuous welded or seamed connection. Anchor to walls with 1/4" x 1/4" x 2" tabs placed at top and bottom ends on either side and at mid-point in between when boots exceed 72" in length. Wall tabs shall be anchored to existing masonry walls with 1/4" expansion sleeve bolts. Boots shall be 8'-0" maximum length and include all required bends, changes in direction and other accompaniments as may be required by the work. A welded in place internal kick shall be provided at the bottom of each boot.
   6. Splash Pans: Manufacturer per Drawings. Spot weld water diverters to base pan. Hem all exposed edges.

B. Prefinished metals shall be 24-gauge and be fastened or installed in the manner listed below. Prefinished metals shall be Bethlehem Steel Corporation Galvalume or galvanized steel, treated, primed and prefinished under precision conditions. Exposed finish shall be Kynar 500 Fluorocarbon coating. Bottom or unexposed side shall be Manufacturer's standard primer coat. Use for all metals indicated on the Drawings and shown hereafter to be exposed to view and not designated for other metal types. All Kynar 500 finished metal is subject to receiving a twenty (20) year finish warranty. Fasteners for these metals must be hot-dipped galvanized or stainless steel as applicable. All metal shall be delivered to the site with a factory-applied protective plastic film which shall be removed immediately upon installation. The color for prefinished metal shall be selected from the Manufacturer's 16-minimum standard choices by the Owner.
   1. Gravel Guard and Cover Plates: Hook at face on continuous 22-gauge galvanized cleat and nail flange at 3" on center staggered with hot-dipped galvanized roofing nails.

2. Coping: Hook at face on continuous 22-gauge galvanized cleat. Secure back leg with neoprene-head screws spaced at 16" on center. Provide with 1" high standing seam joints.
3. Counterflashing and Receiver: Attach receiver as shown in Drawings and noted hereafter. Attach counterflashing to receiver with sheet metal screws spaced at 16" on center.
4. Expansion Joint Hook Strips: Attach with neoprene-head screws spaced at 12" on center.
5. Expansion Joint Cover: Hooked on both sides.
6. Downspouts: Transition from downspout to gutter with 24-gauge galvanized fully soldered drops. Attach downspouts to masonry walls with 12-gauge x 1" galvanized steel straps with two (2) zinc-jacketed masonry drive pins per strap. Anchor straps to downspouts with three (3) stainless steel sheet metal screws, 0.5" maximum length, per strap. Space straps uniformly at 60" on center and cover each joint in the downspout.
8. Gutters: Fastened at 6" on center to substrate wood nailers with stainless steel wood screws and having 12-gauge x 1" galvanized steel straps spaced at 30" on center. Straps shall be anchored with stainless steel sheet metal screws to gutter front edge and back face.

C. Fasteners:
1. Steel Roofing Nails: 11-gauge hot-dipped galvanized nails with annular threaded rings.
2. Neoprene-Head Screws: #10 or #12 stainless steel screws with hexagonal heads and matching color metal jacketed neoprene rubber washer.
3. Stainless Steel Masonry Nails: Stainless steel pin and zinc-jacketed fastener equal to Zamac Screw Type Nailin, minimum 0.25 x 1.5"±.
4. Stainless Steel Masonry Nailer Washer: EPDM sealing washer bonded to Type 304 stainless steel jacket equal to Rawl EPDM Sealing Washer, 3/4" to 1" diameter.
5. Blind Rivets: Stainless steel Series 44. Both rivet and mandrel are to be stainless steel. A mixture of materials will not be permitted. Stainless steel pop rivets shall be used for galvanized and pre-finished metals.
6. Exposed Fasteners: All exposed fasteners to receive metal-jacketed neoprene or EPDM washers. Omit washers where fasteners attach counterflashing to receivers, straps to gutters and downspouts to walls. Exposed horizontal surface fasteners are unacceptable. Other cleats, screws, rivets, bolts, etc. shall be of matching material to which they attach or be galvanically compatible to the surface to which they are secured.

D. Miscellaneous Sheet Metal Related Materials.
1. Plastic Roof Cement: Trowel grade roofing cement conforming to ASTM D4586 (non-asbestos containing).
2. Sealant: Equal to Sonneborn NP-1. One component urethane gun-grade sealant meeting F.S. TT-S-00230-C, Type II, Class A and ASTM C-920-79.
3. Solder: 50% Pig lead and 50% black tin as per ASTM B32.
4. Concrete Splash Blocks: Provide a preformed concrete splash block measuring minimum 12" x 18" at the base of each new downspout. Each downspout shall be provided with a concrete splash block where water is deposited on asphalt, bare ground or planted surfaces. Splash blocks are not required where water is deposited on existing concrete surfaces.

PART 3 - EXECUTION

3.01 INSPECTION

Coordinate all sheet metal work with other roofing work and other trades on this Project for correct sequencing of items which make up the entire Project.

3.02 PREPARATION

A. All sheet metal flanges connected or contacting the roof shall be primed with uniform coating of asphalt primer and set into a full bed of mastic.

B. All joints shall be locked, sealed, welded or soldered as required.

C. All joints, other than those receiving standing seam or cover and back plates, in galvanized sheet metal edging, copings, accessories, flanges and umbrellas, etc. shall be connected by stainless steel blind rivets spaced at 2" on center and fully soldered completely watertight.

D. Expansion joint covers, expansion breaks or other devices so needing same, shall be fitted with watertight standing seam joints allowing for lateral expansion as dictated by gauge of metal, "stretch out" or exposure, and latest printed SMACNA guidelines and criteria.

E. Fabricate new metal in longest practical lengths up to ten feet so as to minimize joints, solder points, welds and seal-offs.

F. Provide for thermal movement of all exposed sheet metal devices.

G. All metal flanges, flashings and other metal items coming in contact with bituminous built-up roof assembly are to be completely primed with asphalt cut back type primer and, as applicable, set in uniform bed of plastic cement for horizontal surfaces or flashing cement for vertical surfaces.

3.03 GENERAL INSTALLATION

A. Includes all sheet metal items associated with the Work.

B. Counterflashing and receiver joints shall be lapped a minimum of 4" and have a 1/4" bead of sealant pressed between the pieces. The sealant shall not be visible from the exterior. The bottom hemmed edge of the counterflashing shall be neatly hooked in bayonet fashion. Metal counterflashings shall completely cover all fasteners used to hold in place top terminations of composition base flashings.

C. Install all sheet metal flashings and accessories in accordance with the latest printed SMACNA guidelines and in accord with recognized roofing and sheet metal industry standards. Fit flashings tightly in place using square and true mitered corners. Surfaces shall be true and straight and lines accurate to profiles encountered.

D. Install new 6" wide cover and backer plates at all new gravel guard, fabricated of matching metal and suitable profile so as to ensure complete and permanent water tight integrity of metal joint. Fasten adjoining 10' metal gravel guard sections as per

most current SMACNA requirements. New cover plates shall be set in specified sealant. Mastic shall not be used in the jointing of gravel guard corners or cover and backer plates. Cover plates shall be neatly bent along the edges to hug the gravel guard over which they are installed. Any gap of more than 1/16" is not allowed. Gravel guard flanges shall be nailed in place not more than 3" o.c. with staggered pattern.

F. Cover plate joints shall be symmetrically laid out so that opposite end sticks of metal are of the same length with all lengths in between being the same. Sample layouts will be required in the field for the Architect=s approval prior to proceeding with the Work.

3.04 CLEANING

A. Remove all bituminous stains from all sheet metal components. Clean exposed sealant from all joints. Sealant shall not remain exposed unless intended by the Drawings.

B. Touch-up paint is not permitted and shall not be used on any exposed prefinished sheet metal component. Any metal receiving touch-up paint shall be completely cleaned to the Architect’s satisfaction, or be replaced.

END OF SECTION

SECTION 07613

MANUFACTURED SHEET METAL ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural lapped seam metal roofing.
   2. Metal facias, flashings, and trim.
   3. Metal gutters and downspouts.

B. Related Sections:
   1. Section 03100 - Concrete Forms and Accessories: Placement of flashing reglets and accessories.
   2. Section 04810 - Unit Masonry Assemblies: Placement of flashing reglets and accessories.
   3. Section 06100 – Rough Carpentry: Wood Blocking.
   4. Section 07213 - Batt Insulation: Flexible insulation under sheet metal roofing system.
   5. Section 07600 - Flashing and Sheet Metal.
   6. Section 07714 - Gutters and Downspouts.
   7. Section 07900 - Joint Sealers.
   8. Section 09900 - Painting and Coatings: Field painting.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Iron and Steel Institute:
   1. AISI SG-973 - Cold-Formed Steel Design Manual.

C. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

F. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

G. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Architectural Sheet Metal Manual.

H. Underwriters Laboratories Inc.:
1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.3 DESIGN REQUIREMENTS

A. Roof Loads: Design to resist live loads with 1/360 maximum deflection.
1. Roof Live Loads: Minimum 20 psf.
2. Dead Loads: Actual weight of materials incorporated into Work.

B. Wind Loads: Design and size components to withstand positive and negative wind loads, including increased loads at building corners.
1. Design Wind Load: To design pressure of 20 psf.

C. Wind Uplift Resistance: UL 580; Class 90.

D. Air Infiltration: Limit air leakage through roof assembly to 0.03 cfm/sq ft of wall area, measured at reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E283.

E. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure of 6.24 psf.

F. Gutter and Downspout Components: Conform to SMACNA Architectural Sheet Metal Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 100 years.

G. Exterior Components: Accommodate the following without damage to system, components or deterioration of seals.

1. Movement within system.
2. Movement between system and perimeter framing components.
3. Dynamic loading and release of loads.
4. Deflection of structural support framing.
5. Expansion and contraction from temperature range of 170 degrees F over 12 hour period.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
1. Indicate metal roofing panel profiles, jointing patterns, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data:
1. Submit data on metal types, finishes, and characteristics.
2. Submit color charts for finish selection.

D. Samples:
1. Submit two samples 12 x 12 inch in size illustrating metal roofing mounted on plywood backing illustrating typical seam, external corner, internal corner, and junction to vertical dissimilar surface, material, and finish.
2. Submit two samples 12 x 12 inch in size illustrating metal finish color.

E. Design Data:
1. Submit structural design calculations for metal roofing supports signed and sealed by professional engineer.

F. Manufacturer's Installation Instructions: Submit instructions including special procedures for roofing penetrations, flashings, and perimeter conditions requiring special attention.

G. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Calculate structural properties of framing members in accordance with AISI SG-973.

B. Perform Work in accordance with SMACNA Architectural Sheet Metal Manual.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five years approved by manufacturer.

C. Design sheet metal roofing under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum two weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with Work of Section 05120 for connecting structural supports to building structural frame.

C. Coordinate with Work of Section 07213 for insulation installed within roof assembly.

1.11 WARRANTY

A. Section 01700 - Execution Requirements: Requirements for warranties.

B. Furnish 10 year manufacturer warranty for sheet metal roofing against structural failure, corrosion, and water penetration].

C. Furnish 20 year manufacturer warranty for metal finish against fading, chipping, chalking, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURED SHEET METAL ROOFING

A. Manufacturers:
   1. MCBI Model PBR.
   2. Substitutions: Section 01600 - Product Requirements.

B. Structural Lapped Seam Metal Roofing: Factory formed metal roofing panel system with exposed fasteners.
   1. Panel Materials: Pre-finished galvalume steel sheet 0.024 inch base metal thickness.
   2. Panel Width: Nominal 36 inches.
   3. Panel Profile: “PBR” by specified manufacturer.
   4. Panel Depth: Nominal 1-1/4 inches.
   5. Seam Type: Lapped.
   6. Color: As selected to match existing.

2.2 SHEET METAL MATERIALS

A. Pre-Finished Galvalume Steel Sheet: ASTM A755/A755M coil coated.
   1. Base Metal: ASTM A792/A792M; Structural Quality, Grade 50 aluminum-zinc alloy coating.
   2. Exposed Finish: Minimum two coat] fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin.
   3. Unexposed Finish: Acrylic coating.

2.3 STRUCTURAL SUPPORTS

A. Roof Framing: Metal framing as specified in Section 05120.

2.4 ACCESSORIES

A. Fasteners: Same material and finish as roofing metal with soft neoprene washers where exposed.

B. Protective Backing Paint: FS TT-C-494, Bituminous.

C. Sealant: Sealant as specified in Section 07900.

D. Plastic Cement: ASTM D4586, Type I.

E. Eave Protection Sheet: Rubberized asphalt bonded to sheet polyethylene, 40 mil total thickness, with strippable treated release paper; Perma-A-Barrier Wall Flashing manufactured by Grace Construction Products.

2.5 FABRICATION

A. Form sections shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate facia, trim, flashing, and other metal components from same material as metal roof panels. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.

C. Fabricate cleats of same material as sheet, to interlock with sheet.

D. Fabricate starter strips of same material as sheet, continuous, to interlock with sheet.

E. Form pieces in longest practical lengths.

F. Hem exposed edges on underside 1/2 inch; miter and seam corners.

G. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

J. Fabricate gutters to profile and size indicated.

K. Fabricate downspouts to profile and size conforming to specified design requirements.

L. Fabricate downspouts to profile and size indicated.

M. Fabricate accessories in profile and size to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA.
   2. Gutter Supports: Straps.
   3. Downspout Supports: Straps.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Structural Framing Substrate:
   1. Verify primary and secondary framing members are installed and fastened, properly aligned and sloped eaves.

2. Verify damaged shop coatings are repaired with touch up paint.

C. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.

D. Verify roofing termination and base flashings are in place, sealed, and secure.

E. Verify insulation is installed and ready for roof application.

3.2 PREPARATION

A. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION - STRUCTURAL SUPPORTS

A. Install structural supports in accordance with Drawings.

B. Align supports with top surface in plane, uniformly sloped to eaves.

C. Secure supports to building structural frame with mechanical fasteners.

3.4 INSTALLATION - EAVE PROTECTION

A. Apply eave protection sheet over deck flange of eave edge flashings.

B. Extend eave protection sheet minimum 2 feet upslope beyond interior face of exterior wall.

C. Place single width eave protection sheet centered over valley, hips and ridges.

D. Place single width eave protection sheet along gable, parallel to gable edge.

3.5 INSTALLATION - LAPPED SEAM METAL ROOFING

A. Install furring configured to continuously support roof panel side laps and receive fasteners.

B. Install roofing panels with long dimension perpendicular to eaves.

C. Install roofing panels beginning at eaves. Weather lap ends minimum 6 inches.

D. Align transverse lapped joints of roofing sheets.

E. Terminate roofing panels with sheet metal trim and flashing for watertight installation. Close and conceal openings between roofing panels, panel seams, and roof substrate.

F. Seal metal joints watertight.

3.6 INSTALLATION - FLASHING

A. Install flashings in accordance with Section 07600.

B. Place eave edge and gable edge metal flashings tight to fascia. Weather lap joints 2 inches and seal with plastic cement. Secure flange to substrate.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

3.7 INSTALLATION - GUTTERS AND DOWNSPOUTS

A. Built-In Gutters:
1. Secure gutter lining to substrate with cleats spaced minimum 24 inches on center along edges of gutters.
2. Longitudinal joints not acceptable.
3. At roof edges, extend gutter lining under metal roofing 6 inches minimum and terminate in 3/4 inch folded edge secured by cleats. Hook lower end of roofing into lock strip to form 3/4 inch wide loose-lock seam.

B. Secure gutters and downspouts in place using [concealed] fasteners.

C. Slope gutters minimum 1/4 inch per foot.

D. Seal gutters watertight. Seal joint of gutter to drain.

E. Terminate downspouts at 8 inches above grade.

F. Set splash pads under downspouts. Secure in place.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes firestopping and through-penetration protection system materials and accessories; firestopping tops of fire rated walls; and smoke sealing at joints between floor slabs and exterior walls.

B. Related Sections:
1. Section 03300 - Cast-In-Place Concrete
2. Section 04810 - Unit Masonry Assemblies
3. Section 05310 - Steel Deck
4. Section 05805 - Expansion Joint Cover Assemblies
5. Section 07900 - Joint Sealers
6. Section 09260 - Gypsum Board Assemblies: Gypsum board fireproofing.
7. Division 15 - Mechanical: Mechanical work requiring firestopping.
8. Division 16 - Electrical: Electrical work requiring firestopping.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E814, UL 1479, and UL 2079 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1-hour fire rating.
   1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

B. Surface Burning: ASTM E84 and UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

A. Manufacturers:
1. A/D Fire Protection Systems, Inc.
2. Dow Corning Corp.
3. Hilti Corp.
4. 3M fire Protection Products.
5. Pecora Corporation.
6. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. iber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.2 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing and damming materials to arrest liquid material leakage.

3.3 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place intumescent coating in sufficient coats to achieve rating required.

3.4 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Protect adjacent surfaces from damage by material installation.
conduit.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing, and accessories.

B. Related Sections:
1. Section 03300 – Cast-In-Place Concrete.
2. Section 04810 – Unit Masonry Assemblies.
3. Section 08800 - Glazing: Glazing sealants and accessories.
4. Section 09260 - Gypsum Board Assemblies: Acoustic sealant.

1.2 REFERENCES

A. ASTM International:
1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
5. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit samples, illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Products Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp.
2. GE Silicones.
3. Pecora Corp.
4. Sonneborn.
5. Substitutions: Section 01600 - Products Requirements.

B. Products Description:
1. High Performance General Purpose Exterior (Nontraffic) Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; multi- component.
   a. Type: Sonolastic NPII manufactured by Sonneborn.
   b. Color: Colors as selected by Architect.
   c. Applications: Use for:
      1) Control, expansion, and soft joints in masonry.
      2) Joints between concrete and other materials.
      3) Joints between metal frames and other materials.
      4) Other exterior nontraffic joints for which no other sealant is indicated.
2. General Purpose Traffic Bearing Sealant: Polyurethane; ASTM C920, Grade P, Class 25, Use T; single component.
   a. Type: SL-1 manufactured by Sonneborn.
   b. Color: Standard colors matching finished surfaces.
   c. Applications: Use for exterior and vehicular traffic bearing joints.
3. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.

a. Applications: Use for [concealed sealant bead in sheet metal work] [and] [concealed sealant bead in siding overlaps].

4. General Purpose Interior Sealant : Acrylic emulsion latex; ASTM C834, single component, paintable.
   a. Type: Sonnelac manufactured by Sonneborne.
   b. Color: Standard colors matching finished surfaces.
   c. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.:
5. Tile Sealant: White silicone; ASTM C920, Uses M and A; single component, mildew resistant.
   a. Type: Silicone Sanitary 1700 Sealant manufactured by GE.
   b. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between toilet room counter tops and wall surfaces.
6. Acoustical Sealant: Butyl or acrylic sealant; ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
   a. Applications: Use for concealed locations only at acoustically rated construction.
      1) Provide sealant bead between top stud runner and structure and between bottom stud track and floor.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, closed cell polyethylene; oversized 30 to 50 percent larger than joint width.
   1. Type: Sonofoam manufactured by Sonneborne.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.4 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF SECTION

SECTION 08114

STANDARD STEEL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes non-rated; thermally insulated steel doors.

B. Related Sections:
1. Section 08115 - Standard Steel Frames.
2. Section 08212 - Flush Wood Doors
3. Section 08710 - Door Hardware.
4. Section 08800 - Glazing: Glass for doors.
5. Section 09900 - Paints and Coatings: Field painting of doors.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM C1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
3. ASTM E413 - Standard Classification for Rating Sound Insulation.

C. Hollow Metal Manufacturers Association:
1. HMMA 810 - Hollow Metal Doors.

D. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Steel Door Institute:
1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

F. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.

G. Uniform Building Code:
1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing and finishes.

C. Product Data: Submit door configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Sample: Submit a 12 inch x 12 inch sample with two sides completely sealed with “Bondo” as specified, ground smooth and primed. Sample shall clearly illustrate the layers of edge detail and panel composition.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Fire Rated Door Construction: Conform to UL 10B.

C. Installed Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

C. Coordinate installation to accommodate door hardware electric wire connections.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

A. Manufacturers:
   1. Ceco Door Products.
   2. Kewanee Corp.
   3. Pioneer Industries.
   4. Republic Builders Products.
   5. Steelcraft.
   6. Substitutions: Section 01600 - Product Requirements.

B. Product Description:
   1. Exterior Doors (Insulated): SDI 108, 1-3/4 inch thick.
      a. Level 3 - Extra heavy Duty, Model 2, seamless design.

2.2 COMPONENTS

A. Face: Steel sheet in accordance with SDI 108.

B. End Closure: Channel, 0.04 inches thick, flush. Thermal Insulated Door: Total insulation R-Value of 7, measured in accordance with ASTM C1363.

C. Top and Bottom Caps: 16 gauge, flush fully sealed with “Bondo” and ground smooth, seamless design.

2.3 ACCESSORIES

A. Astragals for Double Doors: Steel shaped, specifically for double doors.

B. Primer: ANSI A250.10 rust inhibitive type.

2.4 FABRICATION

A. Fabricate doors with hardware reinforcement welded in place.

B. Attach astragal to one inactive leaf of pairs of doors.

C. Attach fire rating label to each fire rated door.

2.5 SHOP FINISHING

A. Steel Sheet: Galvanized to ASTM A653/A653M, A60.

B. Primer: Baked.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install doors in accordance with ANSI A250.8.

B. Install door louvers, plumb and level.

C. Coordinate installation of glass and glazing specified in Section 08800.

D. Coordinate installation of doors with installation of frames specified in Section 08115 and hardware specified in Section 08710.

E. Touch-up damaged shop finishes.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Section 01700 - Execution Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule in the Drawings.

END OF SECTION

SECTION 08115

STANDARD STEEL FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire rated and non-rated steel frames.
   1. Provide frames for exterior glazed lights.

B. Related Sections:
   1. Section 03300 - Cast-In-Place Concrete: Placement of anchors into masonry wall construction.
   2. Section 04810 - Unit Masonry Assemblies: Masonry grout fill of metal frames and placement of anchors into masonry wall construction.
   3. Section 08114 - Standard Steel Doors.
   4. Section 08710 - Door Hardware: Hardware, silencers, and weatherstripping.
   5. Section 08800 - Glazing.
   6. Section 09900 – Painting.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
   1. ASTM A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.

E. Uniform Building Code:
   1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire Rated Frame Construction: Conform to NFPA 252, UL 10B, and UBC Standard 7-2.

C. Fabricate fire rated steel frames in accordance with the requirements of Underwriter’s Laboratories Inc. (UL) and Factory Mutual (FM). Place UL labels where visible when frames are installed in position. Refer to drawings for class requirements.

D. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with frame opening construction, door, and hardware installation.

C. Sequence installation to accommodate required door hardware electric wire connections.

PART 2 PRODUCTS

2.1 STANDARD STEEL FRAMES

A. Manufacturers:
1. Ceco Door Products.
2. Kewanee Corp.
3. Republic Builders Products.
4. Steelcraft.
5. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Standard shop fabricated steel frames, fire rated and non-rated types.
1. Exterior Frames: 16 gage/0.053 inch thick material, base metal thickness.
2. Interior Frames: 16 gage/0.053 inch thick material, base metal thickness.

2.2 ACCESSORIES

A. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

B. Primer: ANSI A250.10 rust inhibitive type.

C. Silencers: Specified in Section 08710.

D. Weatherstripping: Specified in Section 08710.

2.3 FABRICATION

A. Fabricate frames as welded unit.

B. Mullions for Double Doors: Removable type, of same profiles as jambs.

C. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.

D. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frames for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

G. Attach fire rated label to each fire rated frame.

H. Fabricate frames to suit masonry wall coursing with 4 inch head member.

2.4 SHOP FINISHING

A. Steel Sheet: Zinc Coated. ASTM A591 Zinc coated on exterior frames; ASTM A 366 commercial quality on interior frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with masonry, gypsum board, and concrete wall construction for anchor placement.

C. Coordinate installation of glass and glazing specified in Section 08800.

D. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08114.

E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.4 SCHEDULE

A. Refer to Door and Frame Schedule in the Drawings.

END OF SECTION

SECTION 08212

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes flush wood doors; flush and flush glazed configuration; fire rated and non-rated.

B. Related Sections:
   1. Section 08115 - Standard Steel Frames.
   2. Section 08710 - Door Hardware.
   3. Section 08800 - Glazing.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

D. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.
   2. UL - Building Materials Directory.

F. Uniform Building Code:
   1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.

C. Product Data: Submit information on door core materials and construction, and on veneer species, type and characteristics.

D. Samples:
   1. Submit two samples of door veneer, 12 x 12 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWI Quality Standard Section 1300, Premium Grade.

B. Finish doors in accordance with AWI Quality Standard Section 1500.

C. Fire Door Construction: Conform to UBC Standard 7-2.

D. Installed Fire Rated Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Package, deliver and store doors in accordance with AWI Section 1300.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer when stored more than one week.
   1. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Furnish manufacturer's "Life of Installation" warranty for interior doors.

PART 2 PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. Algoma Hardwoods Inc.
   2. VT Industries.
   3. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Solid core flush wood doors; wood veneer facing material; fire rated and non-rated types; flush glazed design; factory pre-fit; shop finished wood doors.
   1. Flush Interior Doors: 1-3/4 inches thick; solid core, seven-ply, fire rated, non-rated, as indicated on Drawings.

2.2 COMPONENTS

A. Solid Core, Non-Rated: AWI Section 1300, Type SLC- 7, Stave lumber core. AWI Premium quality wood, rotary cut, balanced match, book matched grain, for transparent finish.
   1. Wood: Select White Birch.

B. Solid Core, Fire Rated: AWI Section 1300, Type as required for fire rating.Interior Veneer Facing: AWI Premium quality wood, rotary cut, balanced match, book matched grain, for transparent finish.
   1. Wood: Select White Birch.

C. Facing Adhesive: Type I - waterproof.

2.3 ACCESSORIES

A. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.4 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Fabricate fire rated doors in accordance with AWI Quality Standards and to UL requirements. Attach fire rating label to door.

C. Astragals for Fire Rated Double Doors: Reference Section 08710.

D. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.Furnish solid blocking for through bolted hardware.

F. Factory fit doors for frame opening dimensions identified on shop drawings.

G. Cut and configure exterior door edge to receive recessed weather stripping devices.

H. Provide edge clearances in accordance with AWI 1300.

2.5 SHOP FINISHING

A. Factory finish doors in accordance with AWI Quality Standard Section 1500 to the following finish designations; color as selected:
1. Transparent Finish TR-6: Catalyzed polyurethane, Premium quality, satin sheen.Seal door top edge with clear sealer to match door facing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install fire rated and non-rated doors in accordance with AWI Quality Standard, NFPA 80, and to requirements for fire rating label by UL or Intertek Testing Services (Warnock Hersey Listed).

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to maximum of 3/4 inch.

1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

D. Machine cut doors for hardware installation.

E. Coordinate installation of doors with installation of frames specified in Section 08115 and hardware specified in Section 08710.

F. Coordinate installation of glass and glazing specified in Section 08800.

3.3 INSTALLATION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Conform to AWI requirements for fit and clearance tolerances.

C. Conform to AWI Section 1300 requirements for maximum diagonal distortion.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over imaginary 36 x 84 inches surface area.

3.4 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust door for smooth and balanced door movement.

C. Adjust closer for full closure.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule in the Drawings.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Work under this section comprises of furnishing and installing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. **Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the finish hardware suppliers bid.**

B. Items included but are not limited to the following:
1. Hinges – Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates – Pulls
6. Coordinators
7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead controls
10. Electrified Hold Open Devices
11. Thresholds, Gasketing and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories
14. Electrified Hardware Items, Controls and Power Supplies
15. Wiring Diagrams

C. Related Sections:
1. Section 06200 - Finish Carpentry
2. Section 06410 - Custom Cabinets: Cabinet hardware.
3. Section 08114 - Standard Steel Doors.
4. Section 08115 - Standard Steel Frames: Silencers integral with steel frames.
5. Section 08212 - Flush Wood Doors.
7. Division 16 - Electrical

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A117.1 American National Standards Institute – Accessible and Usable

2. ANSI A156.1 - Butts and Hinges.
3. ANSI A156.2 - Bored and Preassembled Locks and Latches.
4. ANSI A156.3 - Exit Devices.
5. ANSI A156.4 - Door Controls - Closures.
6. ANSI A156.5 - Auxiliary Locks and Associated Products.
7. ANSI A156.6 - Architectural Door Trim.
8. ANSI A156.7 - Template Hinge Dimensions.
9. ANSI A156.12 - Interconnected Locks and Latches.
10. ANSI A156.13 - Mortise Locks and Latches.
11. ANSI A156.15 - Closer Holder Release Devices.
12. ANSI A156.16 - Auxiliary Hardware.
13. ANSI A156.18 - Materials and Finishes
14. ANSI A156.23 - Electromagnetic Locks.
15. ANSI A156 - Complete Set of 24 BHMA Standards (A156 Series) with Binder.

B. Builders Hardware Manufacturers Association:
1. BHMA Directory of Certified Products.

C. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 101 – Life Safety Code
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. ADA – American with Disabilities Act – Title III – Public Accommodations

E. U.B.C.7-2-97 and UL 10C

F. State and Local Codes including Authority Having Jurisdiction

G. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 305 - Panic Hardware.
3. UL - Building Materials Directory.

H. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
1. Hardware: Tested in accordance with NFPA 252.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening.

C. Shop Drawings:
1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.
2. Submit manufacturer's parts lists, and templates.

D. Samples:
1. Submit one sample of typical hinge, latchset, lockset, and closer, illustrating style, color, and finish.
2. Approved samples may be incorporated into Work. Samples will be returned to supplier.

E. Electronic Security Hardware: Coordinate installation of the electronic security with the Architect and provide installation and technical data to the Architect and other related sub-contractor(s). Upon completion of the electronic security hardware installation, verify that all components are working properly and state in the required guarantee that this inspection has been preformed.

F. Wiring Diagrams: Provide complete wiring diagrams for each opening requiring electrified hardware, except openings where only magnetic hold-opens are specified. Provide a copy with each hardware schedule submitted after approval. Supply a copy with delivery of hardware to job site and another copy to owner at time of job completion.

G. Doors and Frames used in positive pressure opening assemblies shall meet U.B.C. 7-2-97 and UL10C in areas where this specification includes Gasketing for smoke door.

H. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of installed cylinders and their master key code.

C. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

D. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
1. ANSI A156 series.
2. NFPA 80.
3. UL 305.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

C. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter’s Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

1.7 QUALIFICATIONS

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an A.H.C. or person of equivalent experience who will be made available at reasonable times to consult with the Architect/Contractor and/or Owner regarding any matters affecting the finish hardware on this project.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum two weeks prior to commencing work of this section.

C. Include persons involved with installation of doors, frames, and hardware.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

C. Sequence installation to accommodate required utility connections.

D. Coordinate Owner's keying requirements during course of Work.

1.11 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish two five year manufacturer warranty for locksets and door closers.All finish hardware shall be supplied with a Two- (2) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:
   1. All Closers to have a ten (10) year warranty
   2. All Exit Devices to have a five (5) year warranty
   3. All Locksets to have a five (3) year warranty
   4. All Continuous Hinges to have a ten (10) year warranty

1.12 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements: Maintenance materials.

B. Furnish special wrenches and tools applicable for each different and for each special hardware component.

1.13 EXTRA MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish ten extra key lock cylinders for each master keyed group.

PART 2 PRODUCTS

2.1 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, Bommer or Stanley.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-

removable pins for out swinging doors at secured areas or as called for in this specification.

C. Exterior Door Hinges: Provide out-swinging door hinges of solid bronze or stainless steel with non-removable pins or security studs as called for in this specification.

D. Interior Door Hinges: Wrought steel, polished and plated to match specified finish. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

E. Provide size 4½ inch x 4½ inch for all 1¾ inch thick doors up to and including 36 inches wide. Doors over 1¾ inch through 2¼ inch thick, use 5 inch x 5-inch hinges. Doors over 36 inches use 5 inch x 4½ inch.

F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.

G. Provide heavy weight hinges on all doors over 36 inches in width.

H. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

I. Finishes: At wood doors, hinges are to be plated to match adjacent hardware or as called for in Hardware Sets.At hollow metal doors, hinges are to be USP or stainless steel at exterior out-swinging doors, unless otherwise specified in Hardware Sets.

J. Continuous hinges shall be Ives as specified or equal products manufactured by Select or Markar.

2.2 LOCKS AND LOCK TRIM

A. All of the lock sets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets shall be provided as specified and are Falcon "M" series with the Dane lever. Equal products manufactured by Arrow or Schlage shall be acceptable.

B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 4000 as specified.

1. Hand of lock is to be easily field reversible or non-handed.

2. All lever trim is to be through-bolted through the door.

2.3 CYLINDERS AND KEYING

A. Provide locks and Exit devices requiring cylinders with Arrow cylinders to match the existing key system and comply with performance requirements of ANSI A156.5. All keys to be of nickel silver only. All locks are to be factory keyed to the existing master key system as directed by Laughlin Air Force Base and the Architect. The hardware supplier shall meet with the General Contractor, the Architect, a Representative the Lock manufacturer and a Representative of Laughlin Air Force Base at the project site to determine all permanent keying requirements.

B. Furnish all exterior locks and cylinders with temporary keyed construction cylinders for the duration of construction. Provide ten (10) construction keys total.

C. Cylinders shall be factory keyed and factory maintained as directed by Laughlin Air Force Base. Provide four- (4) keys per cylinder and six- (6) master keys per master used.

D. Stamp all keys “Do not duplicate” and with key symbol as directed by Laughlin Air Force Base.

2.4 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with one piece removable covers, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.

D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets (“Quantum” design). Provide Vandal Resistant Trim as specified in hardware sets.

E. Exit Devices to be the modern push rail design.

F. All devices shall carry a five- (5) year warranty against manufacturing defects and workmanship.

G. Exit Devices shall be Monarch 18 series or equal products manufactured by Arrow, Von Duprin or Sargent.

2.5 SURFACE MOUNTED DOOR CLOSERS

A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maxium degree of opening (trim permitting).

B. All closers to be heavy duty, surface mounted, fully hydraulic, rack and pinion action with high strength iron or aluminum cylinder to provide control throughout the entire door opening cycle.

C. Size all closers in accordance with the manufacturer's recommendations at the factory.

D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature.

E. All closer covers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match closer. Provide closer covers only if provided as a standard part of the door closer package.

F. Closers shall have heavy-duty arms. All closer arms shall be of sufficient length to accommodate the reveal depth and to insure proper installation. The hardware supplier shall provide any and all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

1. All parallel arm mounted closers to be factory indexed to insure proper installation.
2. Furnish heavy-duty cold forged parallel arms for all parallel arm mounted closers.

H. Provide closers with special application and heavy-duty arms as specified in the hardware sets or as otherwise called for to insure a proper operating, long

lasting opening. Drop plates and any additional brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.

I. Finish: Sprayed enamel finish to match other hardware.

J. Closers shall be Dor-O-Matic SC81 series or equal products manufactured by LCN or Sargent.

2.6 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place door stops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified. The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.

D. Finish: Same as other hardware where available.

E. Acceptable Products

1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, Rockwood, Glynn Johnson and Trimco are acceptable.

2.7 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pull's, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Rockwood, Glynn Johnson and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than door width (LDW) as specified. They are to be of 16 gauge (.050 inches) thick stainless steel. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware.

2.8 FLUSH BOLTS AND COORDINATORS

A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Rockwood, Glynn Johnson and Trimco are acceptable. Finish to match adjacent hardware.

2.9 THRESHOLDS AND GASKETING

A. Provide materials and finishes as listed in hardware sets. Equivalent product by National Guard Products, Zero, and Reese are acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.

C. Gasketing shall comply with requirements of U.B.C. 7-2-97 and UL10C.

D. Gasketing shall comply with the requirements of the Wood Door Manufacturer’s certification requirements.

2.10 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.11 DOOR SILENCERS

A. Furnish door silencers at all openings without gasket. Provide two- (2) each at each pair of doors and three - (3) each for each single door.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings. instructed by manufacturer.

C. Verify electric power is available to power operated devices and is of correct characteristics.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer. Hardware is to be installed by experienced finish hardware installers after a pre-installation and pre-wiring meeting between the hardware supplier, hardware manufacturer's representative, electrical contractor, security contractor, hollow metal supplier, wood door supplier and installer**.**

B. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry, secure location to protect against loss and damage.

C. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

D. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.3 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant inspect installation and certify hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust hardware for smooth operation.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Do not permit adjacent work to damage hardware or hardware finish.

3.6 SCHEDULES

A. The following hardware sets are intended to establish type and standard of quality when used together with this section requirements. Examine Drawings and Specifications and furnish proper hardware for door openings.

HW SET: 01
DOOR NUMBER:
102

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	700 83"	630	IVE
1	EA	PANIC DEVICE	18-V-L-DANE-LBR	630	MON
1	EA	PANIC DEVICE	18-V-L-DT-DANE-LBR	630	MON
1	EA	CYLINDER	MC61 X RC62 AS REQUIRED	626	ARR
1	SET	ASTRAGAL	189MA 84"	AL	NGP
2	EA	SURFACE CLOSER	SC81 DS	689	DOR
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	JAMBS WEATHER STRIP	162S 2/84"	AL	NGP
1	SET	HEAD WEATHER STRIP	700SA 1/96"	AL	NGP
1	SET	DRIP CAP	16A 100"	AL	NGP
2	EA	DOOR SWEEP	200SA 48"	AL	NGP
1	EA	THRESHOLD	896V 96"	AL	NGP

HW SET: 02
DOOR NUMBER:
101

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	700 83"	630	IVE
1	EA	PANIC DEVICE	18-R-P-APOLLO	630	MON
1	EA	CYLINDER	MC61 X RC62 AS REQUIRED	626	ARR
1	EA	SURFACE CLOSER	SC81 DS	689	DOR

1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	JAMBS WEATHER STRIP	162S 2/84"	AL	NGP
1	SET	HEAD WEATHER STRIP	700SA 1/36"	AL	NGP
1	EA	DRIP CAP	16A 40"	AL	NGP
1	EA	DOOR SWEEP	200SA 36"	AL	NGP
1	EA	THRESHOLD	896V 36"	AL	NGP

HW SET: 03
DOOR NUMBER:
100

EACH TO HAVE:

4	EA	HINGES	5BB1 4.5 X 4.5	630	IVE
1	EA	DUTCH DOOR BOLT	054	626	IVE
1	EA	CLASSROOM LOCK	M561L DN	626	FAL
1	EA	DEADLOCK	D61	626	ARR
1	EA	MORTISE CYLINDER	MC61 X COLLAR	626	ARR
1	EA	SURFACE CLOSER	SC81 HW/RA	689	DOR
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS441	626	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
4	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes glass glazing for metal frames and doors.

B. Related Sections:
1. Section 07900 - Joint Sealers: Sealant and back-up material other than glazing sealants.
2. Section 08114 - Standard Steel Doors: Glazed doors.
3. Section 08212 - Flush Wood Doors: Glazed doors.
4. Section 10800 - Toilet, Bath, and Laundry Accessories: Metal framed mirrors.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
1. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM C1036 - Standard Specification for Flat Glass.
4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
5. ASTM C1193 - Standard Guide for Use of Joint Sealants.
6. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
7. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
8. ASTM E546 - Standard Test Method for Frost Point of Sealed Insulating Glass Units.
9. ASTM E576 - Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.
10. ASTM E773 - Standard Test Methods for Seal Durability of Sealed Insulating Glass Units.
11. ASTM E774 - Standard Specification for Sealed Insulating Glass Units.

D. Glass Association of North America:

1. GANA - FGMA Sealant Manual.
2. GANA - Glazing Manual.
3. GANA - Laminated Glass Design Guide.

E. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.

F. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with materials described in Section 04820 (Membrane flashing).
2. To utilize inner pane of multiple pane sealed units for continuity of air barrier and vapor retarder seal.
3. To maintain continuous air barrier and vapor retarder throughout glazed assembly from glass pane to heel bead of glazing sealant.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Glass: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

C. Samples:
1. Glass: Submit two samples 12 x 12 inch in size, illustrating each glass unit, coloration and design.
2. Glazing Materials: Submit 6 inch long bead of glazing sealant and gaskets, color as selected by Architect.

D. Certificates: Certify products meet or exceed specified requirements.

E. Manufacturer's Certificate: Certify sealed insulated glass, meets or exceeds specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, GANA Laminated Glass Design Guide for glazing installation methods.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 MOCKUP

A. Section 01400 - Quality Requirements: Requirements for mock-up.

B. Construct mockup 2 x 2 feet including glass.

C. Locate where directed by Architect.

1.8 PRE-INSTALLATION MEETING

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week before starting Work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install glazing when ambient temperature is less than 50 degrees F.

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish ten year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

1.11 GLAZING

A. Manufacturers:
   1. Libbey-Owens-Ford, Inc.
   2. Viracon.
   3. Guardian.
   4. PPG Industries, Inc.
   5. Substitutions: Section 01600 - Product Requirements.

B. Wired Glass Manufacturers:
   1. Guardian Industries, Inc.
   2. Hordis Brothers, Inc.
   3. Substitutions: Section 01600 - Product Requirements.

1.12 COMPONENTS

A. Flat Glass (Type FG): Minimum 1/4 inch unless otherwise indicated.
   1. Clear Float Glass (Type FG-CF): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
   2. Clear Heat Strengthened Glass (Type FG-CH): ASTM C1048, Kind HS, heat strengthened, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
   3. One-Way Reflective Mirror Glass (Type FG-OM): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q2 mirror; size noted on Drawings.

B. Safety Glass (Type SG): Conform to ANSI Z97.1, minimum thickness 1/4 inch unless otherwise indicated.
   1. Clear Tempered Glass (Type SG-CT): ASTM C1048, Kind FT Fully tempered, Condition A, uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.

1.13 ACCESSORIES

A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels.
   1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
   2. Polysulfide Glazing Sealant: ASTM C920, Type M, Grade NS, Class and Use suitable for glazing application indicated; two component; chemical curing, non-sagging type; cured Shore A hardness of 15 to 25.
   3. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
   4. Acrylic Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, solvent curing, non-bleeding; cured Shore A hardness of 15 to 25.

B. Glazing Gaskets: ASTM C864 Option II, resilient neoprene extruded shape to suit glazing channel retaining slot.

C. Pre-Formed Glazing Tape: Size to suit application.
   1. Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
      a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.

D. Setting Blocks: ASTM C864 Option I, Neoprene, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x

width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

E. Spacer Shims: ASTM C864 Option I, Neoprene, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of glazing stop x thickness to suit application.

F. Glazing Clips: Manufacturer's standard type.

G. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units destined for removal for smoke control.

PART 2 EXECUTION

2.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for glazing are correctly sized and within acceptable tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

2.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

2.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
   1. Glazing Sealants: Comply with ASTM C1193.

B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
   1. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
   2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
   3. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

4. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
5. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
6. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

2.4 FIELD QUALITY CONTROL

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Monitor quality of glazing.

2.5 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Remove glazing materials from finish surfaces.

C. Remove labels after Work is complete.

D. Clean glass and adjacent surfaces.

2.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

END OF SECTION

SECTION 09111

NON-LOAD-BEARING METAL FRAMING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes metal stud framing and accessories at interior and exterior locations.

B. Related Sections:
1. Section 04810 - Unit Masonry Assemblies: Veneer masonry supported by stud wall.
2. Section 05500 - Metal Fabrications: Metal fabrications attached to stud framing.
3. Section 06100 - Rough Carpentry: Rough wood blocking within stud framing.
4. Section 09260 - Gypsum Board Assemblies: Wall sheathing.
5. Section 07213 - Batt Insulation: Insulation between framing members.
6. Section 09220 – Portland Cement Plaster.
7. Section 09260 - Gypsum Board Assemblies: Metal studs for partitioning.

1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
5. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
6. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.

B. National Association of Architectural Metal Manufacturers:
1. NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.

C. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SYSTEM DESCRIPTION

A. Exterior Wall: Metal stud framing system infill, with exterior sheathing specified in Section 09260 Gypsum Board Assemblies.

B. Exterior Loads: Design and size components to withstand loads caused by positive and negative pressure of wind acting normal to plane of wall in accordance with 2006 International Building Code to design pressure of 20 lb/sq ft.

C. Maximum Allowable Deflection: 1: 600 span at exterior masonry veneer systems.

D. Wall System:
   1. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   2. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
   1. Indicate component details, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.

C. Product Data: Submit data describing standard framing member materials and finish, product criteria, load charts, and limitations.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C754 and NAAMM ML/SFA 540.

B. Form, fabricate, install, and connect components in accordance with NAAMM ML/SFA 540.

C. Furnish framing materials in accordance with SSMA - Product Technical Information.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   1. Framing Manufacturer: Current member of Steel Stud Manufacturers Association.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. **Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Texas.**

1.7 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of components within stud framing system specified in other sections.

PART 2 PRODUCTS

2.1 METAL FRAMING SYSTEM

A. Manufacturers:
1. Dietrich Industries, Inc.
2. Harrison Manufacturing Co.
3. Unimast Incorporated.
4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Studs: ASTM A591/A591M Coating Class C, non-load bearing rolled steel, channel shaped, punched for utility access, as follows:
1. Depth: As indicated on drawings.
2. Thickness: 20 gage thick minimum; exterior walls 18 gage.

B. Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs. Ceiling Runners: With extended leg retainer.

C. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

D. Fasteners: ASTM C1002, self drilling, self tapping screws.

E. Sheet Metal Backing: 0.036 inch galvanized.

F. Anchorage Devices: Power actuated, drilled expansion bolts, screws with sleeves as required for application.

G. Acoustic Sealant: As specified in Section 09260.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I Inorganic.

2.3 FABRICATION

A. Fabricate assemblies of sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.4 SHOP FINISHING

A. Studs: Galvanize to G90 coating class.

B. Tracks and Headers: Galvanize to G90 coating class.

C. Accessories: Same finish as framing members.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify rough-in utilities are in proper location.

3.2 INSTALLATION

A. Align and secure top and bottom runners at 16 inches oc.

B. Place two beads of acoustic sealant between runners and substrate, studs and adjacent construction to achieve acoustic seal.

C. Place two beads of acoustic sealant between studs and adjacent vertical surfaces to achieve acoustic seal.

D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

E. Install studs vertically at 16 inches oc.

F. Align stud web openings horizontally.

G. Secure studs to tracks using fastener method. Do not weld.

H. Stud splicing not permissible.

I. Fabricate corners using minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

K. Brace stud framing system rigid.

L. Coordinate erection of studs with requirements of door frames, window frames, and; install supports and attachments.

M. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

N. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, and other locations indicated on the Drawings.

O. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Install extended leg ceiling runners.

P. Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Position: 1/8 inch in 10 feet.

C. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09220

PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.1 SUMMARY

A. Section includes Portland cement plaster system.

B. Related Sections:
1. Section 09111 - Non-Load-Bearing Metal Framing System: Metal stud framing behind plaster base.
2. Section 09260 - Gypsum Board Assemblies.
3. Section 09900 - Painting.

1.2 REFERENCES

A. ASTM International:
1. ASTM C91 - Standard Specification for Masonry Cement.
2. ASTM C150 - Standard Specification for Portland Cement.
3. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
4. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
6. ASTM C847 - Standard Specification for Metal Lath.
7. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
8. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.
9. ASTM C933 - Standard Specification for Welded Wire Lath.
10. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
11. ASTM C1328 - Standard Specification for Plastic (Stucco) Cement.
12. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Portland Cement Association:
1. PCA - Portland Cement Plaster (Stucco) Manual.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

D. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on plaster materials, characteristics and limitations of products specified.

C. Samples: Submit two samples, 12 x12 inch in size illustrating finish color and texture.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance PCA Portland Cement Plaster (Stucco) Manual.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Exterior Plaster Work: Do not apply cement plaster when ambient temperature is less than 40 degrees F

PART 2 PRODUCTS

2.1 PORTLAND CEMENT PLASTER

A. Manufacturers:
   1. W.R. Bonsal Co.
   2. The Quikrete Companies.
   3. United States Gypsum Co.
   4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS:

A. Plaster Base Materials:
   1. Cement: ASTM C150, Type I Portland cement. Type N masonry cement.
   2. Lime: ASTM C206, Type S.
   3. Aggregate: Natural sand, within the following sieve sizes and percentage retained limits:
      a. No.4: 0
      b. No.8: 0 to 5

c. No.16: 5 to 30
d. No.30: 30 to 65
e. No.50: 65 to 95
f. No.100: 90 to 100

4. Water: Clean, fresh, potable and free of mineral or organic matter capable of affecting plaster.

B. Plaster Finish Materials:
1. Cement: As specified for plaster base coat, gray color.
2. Lime: As specified for plaster base coat.
3. Water: Clean, fresh, potable, and free of matter capable of affecting plaster.

C. Finish Aggregate:
1. Mineral Aggregate: Finish Coat; Marble No. 8 sieve; Bedding Coat: Sand No.16 sieve.

D. Furring And Lathing:
1. Expanded Metal Lath: ASTM C847, galvanized, diamond mesh, self-furring. Casing Bead: Formed sheet steel, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges, with square edges; galvanized.
2. Corner Bead: Formed sheet steel, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges with radiused edge; galvanized.
3. Base Screed: Formed sheet steel, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges, with beveled edge; galvanized.
4. Control and Expansion Joint Accessories: Formed sheet steel, accordion profile, 2 inch expanded metal flanges each side, galvanized.
5. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
6. Fasteners: ASTM C1002, self drilling, self tapping screws.

2.3 MIXES

A. Dash-Bond Coat: 1 part Portland Cement and maximum 2 parts of sand, proportioned by volume.

B. Base Coats: Mix and proportion cement plaster base coat in accordance with ASTM C926, Type C in accordance with PCA Portland Cement Plaster (Stucco) Manual.

C. Finish Coat: Mix and proportion cement plaster finish coat in accordance with ASTM C926, Type F. in accordance with PCA Portland Cement Plaster (Stucco) Manual.

D. Mix only as much plaster as can be used prior to initial set.

E. Add color pigments to finish coat.

F. Mix materials dry, to uniform color and consistency, before adding water.

G. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

H. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.2 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.

3.3 EXISTING WORK

A. Extend existing Portland cement plaster installations using materials and methods as specified.

B. Repair existing damaged Portland cement plaster which remains or is to be remodeled.

3.4 INSTALLATION

A. Installation of Lathing Materials:
   1. Install metal lath in accordance with ASTM C1063.

B. Installation of Accessories:
   1. Install accessories in accordance with ASTM C1063.
   2. Place corner bead at external wall corners; fasten at outer edges of lath only.
   3. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

4. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
5. Position to provide convenient access to concealed work requiring access.

C. Control And Expansion Joints:Install exterior contraction joints after initial set, scribed every as indicated on Drawings by cutting through 2/3 of cement plaster depth, neatly, in straight lines.
1. For horizontal exterior surfaces, install control and expansion joints not to exceed 100 sq. ft.
2. For vertical exterior surfaces install control and expansion joints as indicated on Drawings.
3. Establish control and expansion joints with specified joint device.

D. Plastering:
1. Apply plaster in accordance with PCA Plaster (Stucco) Manual.
2. Apply base coat to nominal thickness of 3/8 inch, brown coat to nominal thickness of 3/8 inch, and finish coat to nominal thickness of 1/8 inch over metal lath surfaces.
3. Moist cure base and brown coats. Apply brown coat immediately following initial set of scratch coat.
4. After curing, dampen previous coat prior to applying finish coat.
5. Apply finish coat, fine sand float texture with selected color in accordance with PCA Portland Cement Plaster (Stucco) Manual.
6. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.
7. Moist cure finish coat for minimum period of 48 hours.

3.5 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.6 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Remove damaged or defective plaster by cutting and replace with specified materials to match adjacent plaster.

END OF SECTION

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes metal channel ceiling framing; gypsum board and joint treatment; and textured finish.

B. Related Sections:
1. Section 06100 - Rough Carpentry: Wood blocking.
2. Section 08115 - Standard Steel Frames.
3. Section 09111 - Non-Load Bearing Metal Framing System.
4. Section 09111 - Non-Load Bearing Metal Framing System.
5. Section 09220 - Portland Cement Plaster.
6. Section 09900 – Painting.

1.2 REFERENCES

A. ASTM International:
1. ASTM C36 - Standard Specification for Gypsum Wallboard.
2. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
3. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
8. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
9. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 - Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

D. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate special details associated with acoustic seals.

C. Product Data: Submit data on metal framing, gypsum board, joint tape, and acoustic accessories.

D. Samples: Submit two samples of corner and edge reinforcement.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840, ASTM C1280, GA-214, GA-216 and GA-600.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Manufacturers:
   1. Celotex Building Products.
   2. G-P Gypsum Corp.
   3. National Gypsum Co.
   4. United States Gypsum Co.
   5. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Framing Materials:

1. Studs and Tracks: Refer to Section 09111 Non-Load Bearing Metal Framing Systems.
2. Furring, Framing, and Accessories: ASTM C645.
3. Fasteners: ASTM C1002 and GA-216.
4. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
5. Adhesive: ASTM C557 and GA-216.

B. Gypsum Board Materials:
1. Standard Gypsum Board: ASTM C36; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
2. Gypsum Sheathing Board: ASTM C79/C79M; moisture resistant type; 1/2 inch thick, maximum available size in place; ends square cut, square edges; water repellent paper faces. Dens-Glass Gold, as manufactured by Georgia Pacific.

2.3 ACCESSORIES

A. Corner Beads: Metal.

B. Edge Trim: GA-216; Type L and U exposed reveal bead.

C. Joint Materials: ASTM C475; GA-216; reinforcing tape, joint compound, adhesive, and water.

D. Textured Finish Materials: Latex based texturing material.

E. Fasteners: ASTM C1002, Type S12 and GA-216.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 EXISTING WORK

A. Extend existing gypsum board installations using materials and methods as specified.

B. Repair and remodel existing gypsum board assemblies which remain or are to be altered.

3.3 INSTALLATION

A. Metal Stud Installation:
   1. Install studs in accordance with Section 09111.

B. Wall Furring Installation:
   1. Erect wall furring for direct attachment to concrete masonry and concrete walls.
   2. Erect furring channels vertically; space maximum 16 inches o.c, not more than 4 inches from floor and ceiling lines or abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

C. Ceiling Framing Installation:
   1. Install in accordance with ASTM C754 and GA-216.
   2. Coordinate location of hangers with other work.
   3. Install ceiling framing independent of walls, columns, and above ceiling work.
   4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
   5. Laterally brace entire suspension system.

D. Acoustic Accessories Installation:
   1. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

E. Gypsum Board Installation:
   1. Install gypsum board in accordance with GA-216 and GA-600.
   2. Erect single layer board with ends and edges occurring over firm bearing.
   3. Use screws when fastening gypsum board to metal furring or framing.
   4. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
   5. Place control joints consistent with lines of building spaces as directed by the Architect.
   6. Place corner beads at external corners as indicated on Drawings. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and at other locations where detailed. Install reinforcing tape at internal corners.

F. Joint Treatment:
   1. Finish in accordance with GA-214 Level 4.
   2. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   3. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.

G. Texture Finish: Spray apply finish texture coating.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes suspended metal grid ceiling system and perimeter trim.

B. Related Sections:
1. Section 09260 - Gypsum Board Assemblies.
2. Division 15: Sprinkler heads in ceiling system.
3. Division 15: - Air Outlets and Inlets: Air diffusion devices in ceiling system.
4. Division 16: - Interior Luminaries: Light fixtures in ceiling system.
5. Division 16: - Public Address and Music Equipment: Speakers in ceiling system.
6. Division 16: - Fire Alarm and Smoke Detection Systems.

1.2 REFERENCES

A. ASTM International:
1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
3. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association:
1. CISCA - Acoustical Ceilings: Use and Practice.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

D. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal grid system components, acoustic units.

C. Samples: Submit two 12 x 12 inch in size illustrating material and finish of acoustic units.

D. Samples: Submit two 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Conform to CISCA requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

A. Section 0110 - Summary: Work sequence.

B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish 200 sq ft of extra tile to Owner.

PART 2 PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturers:
1. Armstrong World Industries.
2. Celotex Building Products.
3. USG Interiors.
4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Acoustic Tile: ASTM E1264, conforming to the following:
1. Size: 24 x 48 inches.
2. Thickness: 5/8 inches.
3. Composition: Wet formed mineral.
4. Light Reflectance: LR 0.80 percent.
5. NRC Range: 0.55.
6. Ceiling Attenuation Class: Class (CAC Range): Minimum 35
7. Fire Hazard Classification: Class A.
8. Edge: Square.
9. Surface Color: White.
10. Surface Finish: Factory applied vinyl latex paint.
11. Manufacturer: Armstrong Fissured #755, or approved equal.

B. Grid:
1. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
2. Exposed Grid Surface Width: 15/16 inch.
3. Grid Finish: White.
4. Accessories: Stabilizer bars, clips, splices, perimeter trim required for suspended grid system.
5. Support Channels and Hangers: Primed steel; size and type to suit application and ceiling system flatness requirement specified.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify layout of hangers will not interfere with other work.

3.2 EXISTING WORK

A. Extend existing acoustical ceiling installations using materials and methods as specified.

B. Clean and repair existing acoustical ceilings which remain or are to be reinstalled.

3.3 INSTALLATION

A. Lay-In Grid Suspension System:
1. Install suspension system in accordance with ASTM C636 and as supplemented in this section.
2. Locate system on room axis according to reflected ceiling plan.
3. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
4. Install hanger clips during steel deck erection. Install additional hangers and inserts as required.
5. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
6. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
7. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
8. Do not eccentrically load system, or produce rotation of runners.

B. Acoustic Units:
1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
2. Lay directional patterned units as directed by the Architect.
3. Install units after above ceiling work is complete.
4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
5. Cutting Acoustic Units:
   a. Cut to fit irregular grid and perimeter edge trim.
6. Where bullnose concrete block corners occur, install preformed closures to match perimeter molding.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints, stains, and other coatings.
   1. Section 04810 - Unit Masonry Assemblies.
   2. Section 05500 - Metal Fabrications: Shop primed items.
   3. Section 06200 - Finish Carpentry.
   4. Section 08114 - Standard Steel Doors.
   5. Section 08115 - Standard Steel Frames
   6. Section 09220 - Portland Cement Plaster.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
   2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.

B. Painting and Decorating Contractors of America:
   1. PDCA - Architectural Painting Specification Manual.

C. SSPC: The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on finishing products.

C. Samples:
   1. Submit two paper chip samples, 6 x 6 inch in size illustrating range of colors available for each surface finishing product scheduled.

D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum five years documented experience.

C.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.10 SEQUENCING

A. Section 01100 - Summary: Work sequence.

B. Sequence application to the following:
   1. Do not apply finish coats until paintable sealant is applied.
   2. Back prime wood trim before installation of trim.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers: Paint, Transparent Finishes, Stain, Primer Sealers and Block Fillers.
   1. Sherwin Williams.
   2. Coronado Paints.
   3. Devoe Paint Co.
   4. The Glidden Co.
   5. ICI Paint Stores.
   6. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
   1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces and substrate conditions are ready to receive Work as instructed by product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

C. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium and bleach. Rinse with clean water and allow surface to dry.

D. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

F. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

G. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

I. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

J. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by [hand] [power tool] wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. [Prime metal items including shop primed items.]

M. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

N. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

O. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.

P. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

Q. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 EXISTING WORK

A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.4 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

C. Sand wood and metal surfaces lightly between coats to achieve required finish.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

F. Prime concealed surfaces of interior woodwork with primer paint.

G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

H. Finishing Mechanical And Electrical Equipment:
1. Refer to Division 15 and Division 16 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
2. Paint shop primed equipment.
3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
5. Paint exposed conduit and electrical equipment occurring in finished areas.
6. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
7. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated..
8. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 FIELD QUALITY CONTROL

A. 01700 - Execution Requirements: Testing, adjusting, and balancing.

3.6 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.7 SCHEDULE

EXTEROR SCHEDULE - NEW CONSTRUCTION

			MDF/PER COAT	VOC/g/L
A. STUCCO				
1.	Primer:	One coat S-W Loxon Acrylic Primer (A24W300)	3.2	130
2.	Finish:	Two coats SherLastic Elastomeric Coating (A5-100)	12.0	96
B. FERROUS METAL - UNPRIMED				
1.	Primer:	One coat S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440
C. FERROUS METAL - SHOP PRIMED				
1.	Primer:	Touch up as needed with S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440
D. GALVANIZED METAL (NON-FERROUS METAL)				
1.	Finish:	Two coats S-W DTM Acrylic Semi-Gloss Coating (B66W200 Series)	2.5	208

INTERIOR SCHEDULE - NEW CONSTRUCTION

A. CONCRETE MASONRY UNITS (C.M.U.)				
1.	Block Filler:	S-W Heavy Duty Block filler (B42W46)		43
2.	Finish:	Two coats S-W ProMar 200 Interior Latex Semi-Gloss (B31W2200 Series)	1.5	85

B. GYPSUM BOARD - CEILINGS				
1.	Primer:	One coat S-W PrepRite 200 Latex Primer (B28W200)	1.10	86
2.	Finish:	Two coats S-W ProMar 200		
		Interior Latex Eg-Shel (B20W2200 Series)	1.6	142
C. FERROUS METAL - UNPRIMED				
1.	Primer:	One coat S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440
D. FERROUS METAL - SHOP PRIMED				
1.	Primer:	Touch up as needed with		
		S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440
E. GALVANIZED METAL (NON-FERROUS METAL)				
1.	Finish:	Two coats S-W DTM Acrylic Semi-Gloss Coating (B66W200 Series)	2.5	208

INTERIOR SCHEDULE - PREVIOUSLY PAINTED

A. CONCRETE MASONRY UNITS (C.M.U.)				
1.	Block Filler:	Spot Fill Bare CMU S-W Heavy Duty Block filler (B42W46)		43
2.	Finish:	Two coats S-W ProMar 200		
		Interior Latex Semi-Gloss (B31W2200 Series)	1.5	85
B. GYPSUM BOARD				
1.	Primer:	Spot Prime Bare Gypsum S-W PrepRite 200 Latex Primer (B28W200)	1.10	86
2.	Finish:	Two coats S-W ProMar 200		
		Interior Latex Semi-Gloss (B31W2200 Series)	1.5	85
C. WOOD - PAINTED				
1.	Primer:	Spot Prime Bare Wood S-W PrepRite Wall & Wood Oil Primer (B49W2)	1.9	473
2.	Finish:	Two coats S-W ProMar 200		
		Interior Alkyd Semi-Gloss (B34W200 Series)	1.7	442

D. FERROUS METAL - UNPRIMED

1.	Primer:	Spot Prime Bare Metal S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440

E. FERROUS METAL - SHOP PRIMED

1.	Primer:	Spot Prime Bare Metal S-W Kem Kromik Universal Metal Primer (B50WZ Series)	3.0	405
2.	Finish:	Two coats S-W Industrial Enamel (B54 Series)	2.0	440

F. GALVANIZED METAL (NON-FERROUS METAL)

1.	Finish:	Two coats S-W DTM Acrylic Semi-Gloss Coating (B66W200 Series)	2.5	208

END OF SECTION

SECTION 10523

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire extinguishers; fire extinguisher cabinets; and brackets for wall mounting.

B. Related Sections:
   1. Section 06100 – Rough Carpentry: Wood blocking and shims.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.

B. Underwriters Laboratories Inc.:
   1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc.

C. Provide fire extinguisher cabinets classified and labeled by Underwriters Laboratories Inc.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, location, and fire ratings.

C. Product Data: Submit extinguisher operational features, color and finish, and anchorage details.

D. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install extinguishers when ambient temperature are capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Manufacturers:
1. Potter Roemer.
2. JL Industries.
3. Larsen's Manufacturing Co.
4. Substitutions: Section 01600 - Product Requirements.

B. Dry Chemical Type: Model 3310, Multipurpose, with pressure gage; 10 pound capacity; UL rating 4A-80BC.

2.2 FIRE EXTINGUISHER CABINETS

A. Manufacturers:
1. Potter Roemer.
2. JL Industries.
3. Larsen's Manufacturing Co.

B. Substitutions: Section 01600 - Product Requirements.

C. Metal: Formed stainless sheet steel, #304.

D. Configuration: Semi-recessed, Model No.7062-A, sized to accommodate accessories.

E. Trim Type: Returned to wall surface, with 2 1/2 inch projection.

F. Door: 0.016 inch thick, reinforced for flatness and rigidity; lock with break glass access.

G. Door Glazing: Glass, clear, 1/8 inch thick tempered safety glass.

H. Cabinet Mounting Hardware: Appropriate to cabinet.

I. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

J. Pre-drill for anchors.

K. Hinge doors for 180 degree opening with continuous piano hinge. Furnish roller type catch.

L. Weld, fill, and grind components smooth.

M. Glaze doors with resilient channel gasket glazing.

N. Finishing Cabinet Exterior Trim and Door: Stainless Steel, 304 with #4 finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install cabinets plumb and level in wall openings.

B. Secure rigidly in place.

C. Place extinguishers in cabinets and on wall brackets.

D. Position cabinet signage as required by authorities having jurisdiction.

3.3 SCHEDULES

A. In locations indicated on Drawings as “FEC”, provide fire extinguisher and cabinet.

END OF SECTION

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. It is the intent of the Contract Documents to provide an installation complete on every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as provide material and equipment usually provided with such systems or required to complete the installation.

B. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Cutting and patching.
13. Touchup painting and finishing.
14. Mechanical demolition.

C. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 CODES, FEES, PERMITS, STANDARDS AND INSPECTIONS:

A. All work performed under these Specifications shall be in strict accordance with all applicable City, County, State and National Codes, Specifications and Ordinances, and in accordance with all Utility Company regulations.

B. Refer to Conditions of the Contract for payment of fees and permits.

C. All materials and workmanship shall com

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D. The drawings and these specifications are intended to comply with all the above mentioned rules and regulations, however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Contract Officer in writing of said discrepancies and apply for an interpretation and, unless an interpretation is offered in writing by the Contract Officer, the applicable rules and regulations shall be complied with as a part of the contract.

E. In case of difference between building codes, specifications, state laws, industry standards and the Contract Documents, the most stringent shall govern.

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Furnish: Pay for and deliver to the jobsite.

G. Install: Fix permanently in place; make all necessary connections as related to all trades involved, place in operation, and test.

H. Replace: Remove and install.

I. Relocate: Remove and install.

J. Contractor: Contractor responsible for all trades under the specifications covered by this Division.

K. Work: Labor and/or materials accruing in the provision of a system as defined by the drawings and these specifications.

L. Store: Provide an environmentally controlled space to protect the stored equipment from damage prior to installation.

M. Remove: De-energize, disconnect, and de-commission the designated equipment as related to the trades required to take the equipment out of service. This shall include transporting the equipment to an off-site location as required by authorities having jurisdiction and regulatory agencies, unless directed otherwise by the Contract Officer.

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N. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

O. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.5 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Shop Drawings: Detail fabrication and installation for supports and anchorage for mechanical materials and equipment.

C. Coordination Drawings shall include the following:

1. Access panel and door locations.
2. Sheetmetal duct drawings including BOD elevations and structural restrictions.
3. Mechanical Room/A.H.U. Room layout and piping drawings.
4. Cooling Tower piping drawings.
5. Piping/Ductwork handing and supporting details.
6. Environmental/Temperature control pneumatic and electrical diagrams including sequence of operations.
7. HVAC valve tag charts and diagrams.
8. Plumbing valve tag charts, piping lay-outs and diagrams.
9. Sprinkler piping shop drawings including pipe sizes, pipe elevations, routing and head locations.

D. Coordination Drawings: For access panel and door locations.

E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

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1.6 QUALITY ASSURANCE

A. Comply with the applicable ASME Standards for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Materials shall be new and of the quality specified. All materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged shall NOT be repaired at the jobsite, but shall be replaced with new materials.

C. Equipment installed shall have local representation, local factory authorized service, and a local stock of repair parts, within 100 miles of the Project site.

D. Comply with requirements of authorities having jurisdiction.

E. All work shall be performed in the best and most workmanlike manner by mechanics skilled in their respective trades and properly licensed.

F. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.7 PRODUCT UNIFORMITY

A. In order to insure an integrated mechanical system providing ease of maintenance, operation, and repair, similar types of equipment shall be provided by a single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes, tubes, and ductwork with factory or shop applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes, tubes and ducts from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

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D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.10 COORDINATION

A. Contractor shall be responsible for detailing, coordinating and fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions and to conform to the details of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation, furnishing all necessary pilot lines and control lines whether indicated on the drawings or not. At no additional cost to the Owner, make all changes or additions to materials and/or equipment necessary to accommodate structural and architectural conditions.

B. The mechanical plans do not give exact details as to hanging methods of pipes, ducts, materials, etc. Contractor shall refer to the Architectural and Structural Drawings for exact details but without exception all hangers or channels installed under this division of these specifications and spanning between framing members shall be secured to the building structure.

C. The drawings do not give exact details as to elevations of pipe lines nor do they show exact locations of pipe to scale. Piping elevations shall be handled by giving precedence to pipes which require a stated grade for proper operation. Sewer piping shall take precedence over water pipes in determination of elevations. In all cases, pipes requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork. Before installation of piping systems, the Contractor shall refer to the Construction as it is then in progress and determine the exact required locations of these systems in conjunction with advice from the representative of the Contract Officer and/or Owner. Devices necessary for installation and support of pipes, and equipment (such as sleeves, inserts, etc.) shall be located and installed as the construction progresses in order to allow completion of each phase of the work in the proper sequence. Drawings showing the extent and arrangement of the work of a particular trade shall be used together with drawings showing extent and arrangement of work of other trades to insure that the Contractor in laying out and installing his work shall do so in a manner such that the work of the several trades may progress in the most direct, workmanlike harmonious manner.

D. Contractor shall be responsible for the proper location and size of slots, holes or openings in the building structure, and for the correct location of pipe sleeves. The drawings indicate the extent and general arrangement of the various systems, but if any departures from these drawings are deemed necessary by the Contractor, descriptions of these departures and a statement of the reasons therefore, shall be submitted to the Contract Officer as soon as practicable.

E. In general, piping and ductwork in finished areas of the building shall be installed and concealed in chases, furrings, and above suspended ceilings, unless noted and directed otherwise. Should any conditions arise which would cause any piping or ductwork to be exposed in finished areas, it shall be immediately called to the Contract Officer's attention and correction of the discrepancy shall be made in accordance with the Contract Officer's decision. In unfinished spaces such as equipment rooms, all pipe and ductwork shall be installed as high as possible and shall be installed to a continuous grade and shall be square to the building and securely supported. Piping shall be grouped wherever it is feasible to do so.

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F. Equipment shall be installed in such a manner to make oiling devices and parts (such as filters, drives, bearings, etc.) requiring service and maintenance readily accessible.

G. All pipe, duct, etc., shall be cut accurately to measurements established at the building and shall be installed without springing or forcing. All ducts and pipes exposed in machinery and equipment rooms shall be installed parallel to the building planes, except that the lines shall be sloped to obtain the proper pitch. Piping and ducts above furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed during construction until the systems are completed with final connection.

H. The construction details of the building are illustrated on the Architectural and Structural Drawings. For new construction, place all inserts to accommodate the ultimate installation of pipe hangers in the forms before concrete is poured and set sleeves in forms before construction. For existing construction, all required inserts shall be "drilled-in" and all openings required through concrete or masonry shall be "saw-cut" or "core drilled" with tools specifically designed for this purpose.

I. The mechanical plans do not give exact details as to elevations of lines, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other location details. Carefully lay out work at the site to conform to the Architectural and Structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to the details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated satisfactory operation installation.

J. The Mechanical Drawings do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building and in cooperation with other trades. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

K. Contractor shall supply and set in place waterproof flashings where pipes and ducts pass through roofs. The final installation of the flashings shall be coordinated with Division 7 of these Specification.

L. Locations and elevations of the various utilities, included within the scope of the work, have been obtained from utility maps and/or other substantially reliable sources and are offered separate from the contract documents as a general guide only, without guarantee as to accuracy. The Contractor shall examine the site and shall verify to his own satisfaction the size, location and elevations of all utilities and shall adequately inform himself of their relation with the work before entering into a contract.

1.11 EQUIPMENT CONNECTIONS:

A. It is the intent of the Contract Documents that all systems and equipment being furnished under the air conditioning and/or plumbing sections of these specifications shall be provided with all necessary utility connections completed to allow safe and proper operation of said systems. Where it is necessary to make final connections to items of equipment specified under other sections of these Specifications, all such work shall be performed in a neat and workmanlike manner and all materials shall be of quality and finish normally used for such installation.

1.12 EXCAVATION AND BACKFILL:

A. Provide all necessary excavation and BACKFILL for the installation of the plumbing, heating, air conditioning, and ventilating work in accordance with Division 2 of these Specifications.

B. The Contractor shall be responsible for submitting a site specific trench safety system prepared by a registered professional engineer which meets OSHA standards and any additional state and local standards.

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C. Trenches for all underground piping shall be excavated to the required depths. The bottoms of the trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipes resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth 6" below the bottom of the pipe and shall be backfilled to the proper grade with pea gravel thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down to load bearing undisturbed soil. When the pipes have been inspected and approved by inspecting authorities, the trenches shall be backfilled. The trenches shall be carefully backfilled with select fill material or pea gravel to a depth of six (6) inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials if of earth, loam, sand or gravel, free of large clods and with rocks no larger than 1-1/2" in diameter. Backfill shall be installed in layers 12" deep, adequately tamped and wetted down or flushed before the second layer of earth is laid in place.

D. Underground pipes and conduits shall be installed below the local frost-line depth but in no case shall the bury depth be less than 24 inches below finished grade.

E. Obtain soil report from Owner and evaluate existing conditions, and make allowance to provide filled and compacted areas relating to Mechanical, Electrical and Fire Protection work.

1.13 FLAME SPREAD PROPERTIES OF MATERIALS:

A. All materials and adhesives used for air conditioning filters, acoustical lining and insulation, etc. shall conform to NFPA and UL life and safety and flame spread properties of materials. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating for these classifications as listed for the basic materials, the finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

1.14 FLOOR, CEILING AND WALL PLATES:

A. In each finished space, furnish a chromium plated sectional escutcheon on each pipe, or hanger rod penetrating a wall, floor or ceiling. Escutcheons shall be sized to fit snugly to all lines and where the lines are insulated, the escutcheons shall fit snugly over the insulation. Where required, these plates shall be provided with set screws so that they fit snugly against the finished surface.

1.15 OPERATION PRIOR TO COMPLETION

A. When any piece of equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, and properly adjust the operation of the equipment before final acceptance by the Owner.

C. Contractor may operate the HVAC systems prior to owner acceptance of the building providing a climate controlled environment during interior finish construction processes. Contractor shall be responsible for the operation and all maintenance of all equipment and ductwork during this period. Contractor shall install and maintain pre-filters and final filters as specified during construction operations and shall change filters to prevent excessive filter loading.

D. Immediately prior to owner move-in, all equipment, piping, ductwork and all other devices will be cleaned, adjusted and commissioned by this contractor. The warranty period shall begin upon completion of the work above, demonstration of complete and operating systems, and Substantial Completion certified by the Contract Officer.

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1.16 PROJECT RECORD DOCUMENTS AND RECORDS FOR OWNER

A. Project record documentation and records for the Owner shall be as specified in Division 1, General Requirements Section.

B. In addition to the Division 1 of these specification provide the following minimum items:

1. Operations & Maintenance Manuals: Include, as appropriate to each item, sufficient information to provide for the Owner's operation and maintenance of equipment furnished.
2. As-Builts: Include neatly marked set of reproducible drawings showing "As Installed" work.
3. Contacts: Include with each product, name, address, and telephone numbers, of installing contractor, factory and local service representative.
4. Instructions of Owner's Personnel: Prior to final inspection and acceptance, fully instruct the Owner's designated operating and maintenance personnel in the operating and performance of the equipment furnished.
5. Warranties: Include warranty information properly executed by respective manufacturers, suppliers, or sub-contractors for the equipment and system furnished.

1.17 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All electrical equipment, belt driven equipment, projecting shafts and other rotating or energized parts shall be properly enclosed or adequately guarded.

1.18 SPACE AND EQUIPMENT ARRANGEMENT

A. Size of equipment shown by the drawings is based on the dimensions of a particular manufacturer. Where other manufacturers are acceptable, it is the responsibility of the contractor to determine if the equipment he proposes to furnish will fit the space.

B. Equipment shall be installed in a manner that will permit access to all surfaces requiring access. Proper clearances shall be maintained to meet all safety and operating requirements or codes and standards.

1.19 PROTECTION OF MATERIALS AND APPARATUS

A. At all times take such precautions as may be necessary to properly protect the electrical apparatus from damage. This shall include the creation of all required temporary shelters and environmental control to adequately protect any electrical apparatus. Electrical apparatus shall be cribbed up from the floor and covered with protective coverings where necessary to protect the apparatus from damage.

B. As required, apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

C. Damage resulting from failure to comply with this requirement will be considered justification for rejection of the damaged apparatus and requiring its complete replacement by the Contractor.

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1.20 INSPECTION OF BUILDING SITE:

A. Contractor shall visit the site, verifying all existing items indicated on plans and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil, conditions, and local requirements. The submission of bids shall be deemed evidence of each visit. All Proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

1.21 ROOF PENETRATIONS:

A. Roof openings shall be made in accordance with Division 7 of these Specifications.

1.22 ACCEPTABLE MANUFACTURERS

A. Specifications and drawings are intended to indicate a minimum standard of quality for materials and equipment which is established by the listing of manufacturers names and catalog numbers and/or the defining of the technical characteristics in detail or by referenced standards. Materials and equipment that do not comply with these standards of quality will NOT be considered.

B. Contractor shall be responsible to identify any deviation of the submittal from the specified manufacturer, product, equipment or material. Approval by the Contract Officer shall NOT be considered as acceptance of the deviation unless specifically identified and acknowledged by the Contract Officer during the submittal process.

C. Where only one manufacturer’s name is listed in the equipment specification, other manufacturers of similar characteristics and of equal or better performance capacities may be considered for "or equal" approval by the Contract Officer. Where more than one manufacturer is listed in the equipment specification, only those named manufacturers will be considered.

D. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended, within the guarantee or warranty period, this material or equipment shall be replaced with the material or equipment specified at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SLEEVE

A. Above grade and dry location sleeves shall be constructed from 20 gauge galvanized steel and shall be flush on both sides of wall surface penetrated. The sleeves shall be sized to allow free passage of the conduit to be inserted, and when this conduit is to be provided with firestopping, the sleeves shall be large enough to pass the conduit and install the necessary firestopping material. Floor sleeves shall extend two (2”) inches above the finished floor slab elevation.

B. Sleeves passing through walls or floors (except slab on grade) at or below finished grade elevation and/or in moist areas shall be constructed of galvanized steel, schedule 40 pipe, and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the conduits have been installed in the sleeves, insure a waterproof penetration by the use of a "Link-Seal" by Thunderline or "Pipe-Linx" by Mason, Inc. wall sleeve, or shall fabricate a sleeve in accordance with recommendation and sizing furnished by the Thunderline Corporation or Mason, Incorporated.

C. Sleeves passing through fire rated walls or floors shall be sealed with an approved fire-stop material, after installation of the conduit, such that the fire rating of the wall or floor is not degraded.

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2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

a. Watts Industries, Inc.; Water Products Div.
b. Capitol Manufacturing Co.
c. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

a. Capitol Manufacturing Co.
b. Central Plastics Co.
c. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

a. Calpico, Inc.
b. Central Plastics Co.

4. Dielectric Couplings:

a. Calpico, Inc.
b. Lochinvar Corp.

5. Dielectric Nipples:

a. Grinnell Corp.; Grinnell Supply Sales Co.
b. Perfection Corp.
c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

a. Grinnell Corp.; Grinnell Supply Sales Co.
b. Hyspan Precision Products, Inc.
c. Metraflex Co.

7. Mechanical Sleeve Seals:

a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal.

2.3 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: Pipe threads shall comply with the applicable ASME standards for factory-threaded pipe and pipe fittings.

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2.4 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. Comply with the applicable ASME standards, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125 (for plumbing applications) Class 150 (for hydronic applications), cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. Comply with the applicable AWWA standards, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: Comply with the applicable ASME standards, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: Comply with the applicable ASTM standards.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: Comply with the applicable AWS standards.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with applicable AWS standards for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: Comply with the applicable ASTM standards.
2. CPVC Piping: Comply with the applicable ASTM standards
3. PVC Piping: Comply with the applicable ASTM standards. Include primer according to ASTM standards.
4. PVC to ABS Piping Transition: Comply with the applicable ASTM standards.

I. Plastic Pipe Seals: Comply with the applicable ASTM standards, elastomeric gasket.

1. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: Comply with the applicable AWWA standards, rubber gasket, carbon-steel bolts and nuts.

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2.5 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.6 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2 inch NPS (DN50) and Smaller: Threaded.
2. 2 ½ inch NPS (DN65) and Larger: Flanged
3. Option for 2 ½ Inch NPS (DN654) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Included copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum working pressure rating at 220 deg F (104 deg C) . Units may be straight or elbow type, unless otherwise indicated.

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2.7 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

a. Finish: Rough brass.
b. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

a. Finish: Rough brass.
b. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: Comply with the applicable ASTM standards.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

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G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
    b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 for flashing.
    c. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 for materials.
5. Use neutral-curing silicone sealant, unless otherwise indicated.

O. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

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P. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to the applicable ASME standards. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    c. Align threads at point of assembly.

    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to the applicable AWS standards, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.

7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

    a. Comply with the applicable ASTM standards for safe-handling practice of cleaners, primers, and solvent cements.
    b. ABS Piping: Comply with the applicable ASTM standards.
    c. CPVC Piping: Comply with the applicable ASTM standards.
    d. PVC Pressure Piping: Comply with the applicable ASTM standards.
    e. PVC Nonpressure Piping: Comply with the applicable ASTM standards.
    f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to the applicable ASTM standards.

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9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to the applicable ASTM standards procedures and manufacturer's written instructions.

    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.

U. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Contract Officer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Refer to Division 9 for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

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C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS Standards, "Structural Welding Code--Steel."

3.6 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.8 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

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D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.9 OWNER FURNISHED EQUIPMENT

A. Where the Owner has elected to procure some equipment for the project, it is the intent of these specifications that the Contractor shall accept responsibility of this equipment and provide the following:

1. Coordinate shop drawing preparation.
2. Provide supervision to coordinate shipping and accept delivery.
3. Install and set in place.
4. Provide power and control wiring to provide functions in accordance with these specifications.
5. Deliver the equipment to the Owner in a workable, operating, and tested condition.
6. Provide supervision to coordinate factory and on-site testing, start-up, and commissioning in accordance with these specifications.
7. Provide supervision to coordinate Owner training and preparation of O&M Manuals.

B. Coordinate list of equipment provided by Owner with Owner.

END OF SECTION 15050

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SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions and other Specification Sections of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports, channel support systems and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code.

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:

a. B-Line Systems, Inc.
b. Grinnell Corp.
c. PHD Manufacturing, Inc.
d. Piping Technology & Products, Inc.

2. Channel Support Systems:

a. B-Line Systems, Inc.
b. Grinnell Corp.; Power-Strut Unit.
c. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:

a. PHS Industries, Inc.
b. Pipe Shields, Inc.
c. Rilco Manufacturing Co., Inc.

4. Powder-Actuated Fastener Systems:

a. Gunnebo Fastening Corp.
b. Hilti, Inc.
c. ITW Ramset/Red Head
d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components. MSS Standards, Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Insulated Cold Piping: Applicable ASTM Standards, Type I calcium silicate with vapor barrier.
2. Material for Insulated Hot Piping: Water-repellent-treated, applicable ASTM Standards, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

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5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: Applicable ASTM standard steel plates, shapes, and bars, black and galvanized. All exterior pipe support systems shall be zinc rich hot dip galvanized.

D. Grout: Applicable ASTM standards, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS standards for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS standards): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Yoke-Type Pipe Clamps (MSS standards): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS standards): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS standards): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS standards): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS standards): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS standards): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS standards): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS standards): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS standards): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).

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11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS standards): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS standards): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
13. Clips (MSS standards): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS standards): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS standards): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS standards): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS standards): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS standards): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS standards): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS standards): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS standards): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS standards): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS standards): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS standards): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS standards): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS standards): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS standards): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS standards): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS standards): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS standards): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS standards): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS standards): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS standards): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS standards): For structural shapes.

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7. Top-Beam Clamps (MSS standards): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS standards): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS standards): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS standards): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS standards): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS standards): 750 lb (340 kg).
    b. Medium (MSS standards): 1500 lb (675 kg).
    c. Heavy (MSS standards): 3000 lb (1350 kg).

13. Side-Beam Brackets (MSS standards): For sides of steel or wooden beams.
14. Plate Lugs (MSS standards): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS standards): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS standards): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS standards): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Restraint-Control Devices (MSS standards): Where indicated to control piping movement.
2. Spring Cushions (MSS standards): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS standards): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS standards): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS standards): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS standards): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS standards): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS standards): Mounted horizontally.
    b. Vertical (MSS standards): Mounted vertically.
    c. Trapeze (MSS standards): Two vertical-type supports and one trapeze member.

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3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS Standards. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM Standards, steel shapes selected for loads being supported. Weld steel according to AWS Standards.

C. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME Standards," is not exceeded.

I. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operated Above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operated Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME Standards.

2. Install thermal-hanger shield inserts. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

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4. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS standard procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section “Painting”.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM Standards.

END OF SECTION 15060

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SECTION 15075 – MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. Product Data: For identification materials and devices.

B. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

C. Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Comply with ASME Standards, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

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2. Location: Accessible and visible.

C. Snap-On Plastic Pipe Markers (for pipe less than 125ºF): Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME Standards, unless otherwise indicated.

D. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

E. Lettering: Manufacturer's standard preprinted captions as selected by Engineer.

F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils (0.08 mm) thick.
1. Width: 1 ½ inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2 ½ inches (65 mm) for larger pipes.
2. Color: Comply with ASME Standards, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with ¼ inch (6-mm) letters for piping system abbreviation and ½ inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
1.
2. Material: 3/32-inch (2.4-mm) thick plastic laminate with 2 black surfaces and a white inner layer.
3. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
4. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass S-hooks.

J. Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.

K. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.
1. Frame: Finished hardwood.

L. Engraved Plastic-Laminate Signs: ASTM D , Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch (2 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

M. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME STANDARDS.
6. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

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7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
8. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

C. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by the following method:
1. Laminated or bonded application of pipe marker to pipe or to insulation.

D. Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by the following method:
1. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

E. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at a maximum of 25-foot (15-m) intervals along each run. Reduce intervals in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
8. All locations where its service or duty is not readily apparent.

3.2 VALVE TAGS

A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme and with captions similar to those indicated in the following:

C. Tag Material: Brass.

D. Tag Size and Shape: According to the following:
1. Cold Water: 2 inches (50 mm), round.
2. Hot Water: 2 inches (50 mm), round.
3. Sprinkler: 2 inches (50 mm), round.
4. Gas: 2 inches (50 mm), round.
5. Cold Water (Non Potable): 2 inches (50 mm), round
6. Fuel Oil: 2” inches (50 mm), round

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7. Fire Protection: 2 inches (50 mm), round

E. Tag Color: According to the following:
1. Hot Water: Yellow
2. Fire Protection: Red
3. Gas: Yellow
4. Chilled Water: Blue
5. Condenser Water: Natural
6. Cold Water (Non Potable): Yellow
7. Fuel Oil: Yellow
8. Cold Water: Green
9. Sprinkler: Red

F. Letter Color: According to the following:
1. Cold Water: White
2. Hot Water: Black
3. Fire Protection: White
4. Sprinkler: White
5. Gas: Black
6. Chilled Water: White
7. Condenser Water: Black
8. Cold Water (Non Potable): Black
9. Fuel Oil: Black

G. Install glass frame mounted valve schedule in each major equipment room.

3.3 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Fire department hose valves and hose stations.
3. Meters, gages, thermometers, and similar units.
4. Fuel-burning units, including boilers, and heaters.
5. Pumps, compressors, chillers, and similar motor-driven units.
6. Cooling towers, and similar equipment.
7. Fans, blowers, primary balancing dampers, and mixing boxes.
8. Packaged HVAC air handling units and fan coil units.
9. Tanks and pressure vessels.
10. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 15075

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SECTION 15081 – DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Division 15 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
3. Division 15 Section "Pipe Insulation" for insulation for piping systems.
4. Division 15 Section "Metal Ducts" for duct liner.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Removable insulation sections at access panels.
2. Application of field-applied jackets.
3. Applications at linkages for control devices.

C. Samples: For each type of insulation and field-applied jacket. Identify each Sample, describing product and intended use. Submit 12-inch- (300-mm-) square sections of each sample material.

D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to applicable ASTM standards, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

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1. Insulation Installed Indoor and Outdoor: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.
b. Rubatex Corp.

3. Closed-Cell Phenolic-Foam Insulation:

a. Kooltherm Insulation Products, Ltd.

4. Calcium Silicate Insulation:

a. Owens-Corning Fiberglas Corp.
b. Pabco.
c. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with applicable ASTM standards, for Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

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B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM standards, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge or expanded-rubber materials. Comply with Applicable ASTM standards for Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

D. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM standards, Type II, Grade 1.

E. Calcium Silicate Insulation: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM standards, Type I for temperatures up to 1200 and ASTM standards, Type II for temperatures up to 1700 deg F (927 deg C).

2.3 FIELD-APPLIED JACKETS

A. General: Company with applications ASTM Standards, for Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: White or as selected by the Contract Officer.

D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with applicable ASTM standards, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.

1. Finish: Smooth finish.
2. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.

E. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with applicable ASTM standards for type 304 or 316; 0.10 inch (2.5 mm) thick; and roll stock ready for shop or field cutting and forming to indicate size.

1. Moisture Barrier: 1 mil (0.025 mm) thick, heat bonded polyethylene and kraft paper.
2. Jacket Bands: Stainless Steel, Type 304, ¾ inch (19 mm) wide.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Provide Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Applicable ASTM Standards, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.

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C. Wire: 0.062-inch (1.6-mm), soft-annealed, stainless steel

D. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

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J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

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b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.

4. Impale insulation over anchors and attach speed washers.
5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch (150-mm) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Space anchor pins as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.

4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

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3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.6 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation as follows:

1. Secure each layer of insulation to duct with stainless-steel bands at 12-inch (300-mm) intervals and tighten without deforming the insulation materials.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. On exposed applications, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.7 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation according to the manufacturer's written instructions and as follows:

1. Secure single layer of insulation to duct with stainless-steel bands. Tighten bands without deforming the insulation material.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire. Secure outer layer with stainless-steel bands.
3. On exposed applications, without metal jacket, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.8 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.9 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

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C. Color: Final color as selected by Contract Officer. Vary first and second coats to allow visual inspection of the completed Work.

3.10 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed round supply ductwork.
2. Outdoor exposed supply and return ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Fibrous-glass ducts.
2. Indoor metal ducts with duct liner.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
5. Flexible connectors.
6. Vibration-control devices.
7. Testing agency labels and stamps.
8. Nameplates and data plates.
9. Access panels and doors in air-distribution systems.

3.11 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round, supply-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

B. Service: Round, return-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: No

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3.12 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

1. Service: Rectangular, supply-air ducts.

2. Material: Closed-cell phenolic foam.
3. Thickness: 3 inches (50 mm).
4. Number of Layers: One.
5. Field-Applied Jacket: Aluminum.

   a. Aluminum Thickness: 0.032 inch (0.8 mm).
   b. Corrugation Dimension: 2-1/2 by 5/8 inch (64 by 16 mm).

6. Vapor Retarder Required: Yes.

B. Service: Rectangular, return-air ducts.

1. Material: Closed-cell phenolic foam.
2. Thickness: 3 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Aluminum.

   a. Aluminum Thickness: 0.032 inch (0.8 mm).
   b. Corrugation Dimension: 2-1/2 by 5/8 inch.

5. Vapor Retarder Required: Yes.

END OF SECTION 15081

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SECTION 15815 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes rectangular, round metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 1- to plus 6-inch wg (minus 249 to plus 1494Pa).

B. Related Sections include the following:

1. Division 15 For duct insulation.
2. Division 15 For dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

B. Where any reference to “sheetmetal work” or “ductwork” appears in this section of these specification or on the drawings, it shall be construed to include air ducts and all other related pieces and parts of the air conveying systems.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Contract Officer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Product Data: For duct liner and sealing materials.

B. Shop Drawings: Show details of the following:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating pressure classifications, duct sizes, and bottom of duct elevations on plans.
3. Fittings.

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4. Reinforcement and spacing.
5. Seam and joint construction.
6. Penetrations through fire-rated and other partitions.
7. Terminal unit, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling and wall mounted access doors and panels required to provide access to dampers and other operating devices.
4. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

B. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

D. Comply with ASHRAE 90.1 - 1999, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

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B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

C. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14, sheet form with standard, one-side bright finish for ducts exposed to view and with mill finish for concealed ducts.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

G. Each sheet shall be stenciled with manufacture's name and gauge. If coil steel is used, coils shall be stenciled throughout on 10-foot centers with manufacture's name and gauge.

2.2 DUCT LINER

A. General: Comply with NFPA 90A or NFPA 90B and NAIMA's "Fibrous Glass Duct Liner Standard."

B. Materials: ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers.

1. Thickness: Refer to Part 3 for scheduled thickness
2. Thermal Conductivity (k-Value): 0.25 at 75 deg F (0.036 at 24 deg C) mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to ASTM C 411.
4. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.
5. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

    a. Tensile Strength: Indefinitely sustain a 50-lb- (23-kg) tensile, dead-load test perpendicular to duct wall.
    b. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch (3 mm) into airstream.
    c. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

6. Liner shall be manufactures by Manville, Owens Corning, or Certainteed Equal to Manville Permacote Linacoustic.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

1. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.
2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

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2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.5 RECTANGULAR DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

1. Primary Air Duct : 1-inch wg (250 Pa).
2. Toilet Exhaust Riser/Ductwork: 1-inch wg (250 Pa), negative pressure.
3. Transfer Air/Combustion Air Ductwork: 0.5-inch wg (125 Pa).
4. Return Air Ductwork: 1-inch wg (250 Pa), negative pressure.
5. All Other: 1-inch wg (250 Pa).

C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

2.6 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness are prohibited.

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B. Apply adhesive to liner facing in direction of airflow not receiving metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

G. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely around perimeter; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts.

I. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire-damper sleeve.

2.7 ROUND DUCT FABRICATION

A. Round Ducts: Fabricate supply ducts of galvanized steel according to Spiral Pipe of Texas, National Duct System, or United Sheet Metal Products recommendations.

2.8 ROUND SUPPLY AND EXHAUST FITTING FABRICATION

A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

C. Elbows: Fabricate in die-formed or gored-construction. Fabricate bend radius of die-formed, and gored elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Round Elbows, 8 Inches (200 mm) and Smaller: Fabricate die-formed elbows for 45 and 90 degree elbows and gored elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
2. Round Elbows, 9 through 14 Inches (225 through 355 mm): Fabricate gored elbows for 30, 45, 60, and 90 degrees,. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
3. Round Elbows, larger than 14 Inches (355 mm): Fabricate gored elbows.
4. Die-Formed Elbows for Sizes through 8 Inches (200 mm) and All Pressures: 0.040 inch (1.0 mm) thick with two-piece welded construction.
5. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

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2.9 Ductwork Lagging:

A. 2" high density filter glass 6lb/cu. ft. covered with 2 layers of 5/8 " thick sheetrock similar to US Gypsum fire rated.

B. Seal with acoustical sealant.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install round ducts in lengths not less than 12 feet (3.7 m), unless interrupted by fittings.

D. Install ducts with fewest possible joints.

E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct.

G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

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3.2 DUCT LINER SCHEDULE:

A. 3-inch thick liner:

1. Outdoors: Supply and return air ductwork.

B. 2-inch thick liner:

1. Supply and return air ductwork as indicated on drawings.

C. 1 - ½ inch thick liner:

1. Supply and return air ductwork not externally insulated.

D. ½ -inch thick liner:

1. Toilet exhaust air duct work.

3.3 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in ASHRAE 90.1-1999 and SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Seal externally insulated ducts before insulation installation.

3.4 HANGING AND SUPPORTING

A. Install rigid round and rectangular metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet (5 m) and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install concrete inserts before placing concrete.

3.5 CONNECTIONS

A. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

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3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2 inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2 to 10 inch wg (500 to 2500 Pa).
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.7 ADJUSTING

A. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.8 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 15815

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SECTION 15820 – DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Combination fire and smoke dampers.
6. Turning vanes.
7. Duct-mounting access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

B. Related Sections include the following:

1. Division 16 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
2. Division 15 Section "Building Management System (BMS)" for electric and pneumatic damper actuators.
3. Division 15 Section "Sequence of Operations ".

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Combination fire and smoke dampers.
6. Turning vanes.
7. Duct-mounting access doors.
8. Flexible connectors.
9. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.

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4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. ASHRAE 90.1 - 1999, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings." compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with the most current publication of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with the applicable ASTM A standards and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: Comply with the applicable ASTM standards, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM standards, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

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2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. American Warming and Ventilating
2. Greenheck.
3. Pottorff
4. Prefco Products, Inc.
5. Ruskin Company.
6. Vent Products Company, Inc.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch (150-mm) width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch (1.3-mm) thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch (0.6-mm) thick, roll-formed aluminum.

E. Blade Seals: Neoprene.

F. Blade Axles: Galvanized steel.

G. Tie Bars and Brackets: Galvanized steel.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. American Warming and Ventilating.
2. Flexmaster U.S.A., Inc.
3. McGill AirFlow Corporation.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Pottorff
7. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch (1.62-mm) thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch (2.5-mm) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.

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4. Roll-Formed Aluminum Blades: 0.10-inch (2.5-mm) thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch (1.2-mm) thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze.
8. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple or single-blade, parallel or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: U-shaped, galvanized sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch (1.62-mm) thick, galvanized sheet steel.
3. Aluminum Frames: U-shaped, 0.10-inch (2.5-mm) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch (2.5-mm) thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch (1.2-mm) thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze thrust or ball.
8. Blade Seals: Neoprene.
9. Jamb Seals: Cambered.
10. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch (25-mm) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32 inch (2.4-mm) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Duro Dyne Corp.
4. Greenheck.
5. McGill AirFlow Corporation.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. Pottorff
9. Ruskin Company.
10. Vent Products Company, Inc.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch (2.8-mm) thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch (1.61-mm) thick, galvanized-steel damper blades with maximum blade width of 8 inches (203 mm).

1. Secure blades to 1/2-inch (13-mm) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

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3. Provide closed-cell neoprene edging opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage (except for outdoor and exhaust dampers) at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D. Dampers used for outdoor air and exhaust air shall meet ASHRAE 90.1 standards.

C. Provide factory mounted contact to indicate damper position status where monitoring is required. Position indication shall be a UL rated component.

2.6 FIRE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Pottorff
5. Ruskin Company.
6. Vent Products Company, Inc.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1 ½ or 3 hours, refer to wall fire rating.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034 inch (0.85-mm) thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch (0.85-mm) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch (0.85-mm) thick, galvanized steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

J. Damper shall be rated to close while air is moving thru damper.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Nailor Industries Inc.
3. Pottorff
4. Ruskin Company.
5. National Control Air

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B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1 ½ hour rating.

C. Electronic Fusible Links: Resetable, 165 deg F (74 deg C) rated.

D. Frame and Blades: 0.064-inch (1.62-mm) thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch (1.3-mm) thick, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Provide for modulating or two-position action.

1. Permanent Split Capacitor or Shaded-Pole Motors: With oil immersed and sealed gear trains.
2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
4. Nonspring Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
5. Electrical Connection: 115 V, single phase, 60 Hz.

G. Provide factory mounted contract to indicate damper position status. Position indication shall be a UL rated component.

2.8 TURNING VANES

A. Fabricate to comply with the most recent edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. Ward Industries, Inc.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

1. Manufacturers:

a. American Warming and Ventilating.
b. Ductmate Industries, Inc.

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c. Flexmaster U.S.A., Inc.
d. Greenheck.
e. McGill AirFlow Corporation.
f. Nailor Industries Inc.
g. Pottorff
h. Ward Industries, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches (300 mm) Square: Secure with two sash locks.
b. Up to 18 Inches (450 mm) Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.
d. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch (25-mm) thickness. Include cam latches.

1. Manufacturers:

a. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics, Inc.
3. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm) thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

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F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd. (542 g/sq. m).
2. Tensile Strength: 285 lbf/inch (50 N/mm) in the warp and 185 lbf/inch (32 N/mm) in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

2.11 FLEXIBLE DUCTS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. McGill AirFlow Corporation.

B. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

C. Insulated-Duct Connectors: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20.3 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 28 to plus 99 deg C).

D. Insulated-Duct Connectors: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20.3 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 28 to plus 99 deg C).

E. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches (75 to 450 mm) to suit duct size.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

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C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as required or indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct silencers rigidly to ducts.

I. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. On sides of ducts where adequate clearance is available.

J. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches (200 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 12 inches (300 mm) in diameter.
4. Head and Shoulders Access: 18 inches (460 mm) in diameter.
5. Body Access: 24 inches (600 mm) in diameter.

L. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: 7 inches (175 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 13 inches (330 mm) in diameter.
4. Head and Shoulders Access: 19 inches (480 mm) in diameter.

M. Label access doors according to Division 15 Section "Mechanical Identification."

N. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

O. For fans developing static pressures of 5-inch wg (1250 Pa) and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

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Q. Connect flexible ducts to metal ducts with draw bands plus sheet metal screws.

R. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

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SECTION 15855 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes floor-, ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, ADPI, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Plans, drawn to scale, on which other equipment are shown and coordinated with each other, based on input from installers of the items involved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Price
2. Titus
3. Krueger

B. Material: Refer to schedule.

C. Finish: Refer to schedule.

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2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

B. NFPA Compliance: All diffusers meet NFPA 90A.

1. Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less as tested by ASTM E84 or ASTM 1187.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Contract Officer for a determination of final location.

C. Floor-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. Where architectural features or other items conflict with installation, notify Contract Officer for a determination of final location

D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

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SECTION 15990 – TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

I. Test: A procedure to determine quantitative performance of a system or equipment.

J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

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K. AABC: Associated Air Balance Council.

L. AMCA: Air Movement and Control Association.

M. CTI: Cooling Tower Institute.

N. NEBB: National Environmental Balancing Bureau.

O. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Contract Officer’s representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. Contract Documents examination report.
c. Testing, adjusting, and balancing plan.
d. Work schedule and Project site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

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C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for AABC Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Guarantee: Provide a guarantee on AABC forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division 1 Section "Project Record Documents."

D. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data, including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and start up specified in individual Specification Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

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O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine equipment for installation and for properly operating safety interlocks and controls.

Q. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
5. Sensors are located to sense only the intended conditions.
6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to design values.

R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

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3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component.

a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.

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4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Adjust fan speed higher or lower than design with the approval of the Contract Officer. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.7 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and start up complete.

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B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.8 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

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C. Final Report Contents: In addition to the certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:

    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.

E. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:

1. Duct, outlet, and inlet sizes.

F. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data: Include the following:

    a. System and air-handling unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F (deg C).
    d. Duct static pressure in inches wg (Pa).
    e. Duct size in inches (mm).
    f. Duct area in sq. ft. (sq. m).
    g. Design airflow rate in cfm (L/s).
    h. Design velocity in fpm (m/s).
    i. Actual airflow rate in cfm (L/s).
    j. Actual average velocity in fpm (m/s).
    k. Barometric pressure in psig (Pa).

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G. Instrument Calibration Reports: For instrument calibration, include the following:

1. Report Data: Include the following:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

END OF SECTION 15990

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SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to furnish same as well as furnish and install material and equipment usually furnished with such systems or required to complete the installation.

B. This Section includes the following:

1. Supporting devices for electrical components.
2. Concrete equipment bases.
3. Codes, fees, permits, standards, inspections, field quality control, and submittal requirements.
4. Electrical demolition, excavation and backfill.
5. Cutting and patching for electrical construction.
6. Project record documentation.
7. Safety guards.
8. Space and equipment arrangement.
9. Refinishing and touchup painting.
10. Cleaning and protection of apparatus.
11. Electrical component identification.

1.3 CODES, FEES, PERMITS, STANDARDS AND INSPECTIONS

A. Work performed under these Specifications shall be in strict accordance with the National Electrical Code (NEC), Occupational Safety and Hazard Act (OSHA), Institute of Electrical and Electronic Engineers (IEEE), Underwriter's Laboratory (UL), National Fire Protection Association (NFPA), all applicable City, County, State, and National codes, specifications, standards and ordinances, and in accordance with all Utility Company regulations.

B. Refer to conditions of the Contract for payment of fees and permits.

C. Drawings and these specifications are intended to comply with all the above mentioned rules and regulations, however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Contract Officer in writing of said discrepancies and apply for an interpretation and, unless the Contract Officer offers an interpretation in writing, the applicable rules and regulations shall be complied with as a part of the contract.

D. In case of difference between building codes, specifications, state laws, industry standards and the Contract Documents, the most stringent shall govern. However, inform the Contract Officer of the discrepancy and ask for a written response.

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1.4 SUBMITTALS

A. Shop Drawings: Dimensioned plans and sections or elevation layouts of electrical equipment rooms.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Coordination Drawings: Drawings showing the extent and arrangement of the work of a particular trade and the extent and arrangement of work of other trades to insure that the Contractor in laying out and installing his work, shall do so in a manner such that the work of the several trades may progress in the most direct, workmanlike and harmonious manner.

D. Submittal Schedule: List of proposed submittals shall be provided in a schedule form indicating the extent of the submittal, shop drawings, product data, test reports, record drawings, and similar items that the Contractor intends to submit for approval. The submittal schedule shall be provided within thirty (30) days of award of contract and prior to any formal submittals being provided.

E. Deviations: The approval of Submittal Drawings by the Contract Officer, or Representative, shall not relieve the Contractor from responsibility for deviation from Drawings or the specifications unless he has called attention in writing to such deviations at the time of submission and has obtained written approval from the Contract Officer, or Representative, of such deviations. The Contractor at no extra cost will make any proposed change necessary for compliance with the specifications to the Owner.

1.5 QUALITY ASSURANCE

A. Provide products and materials that are listed and labeled. The terms “Listed” and “Labeled” shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Materials shall be new and of the quality specified. All materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged shall NOT be repaired at the jobsite, but shall be replaced with new materials.

C. Equipment installed shall have local representation, local factory authorized service, and a local stock of repair parts, within 100 miles of the Project site.

D. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power, communications and other services.

E. Equipment Changes: The electrical design and drawings are based on the equipment scheduled, specified and indicated by the drawings and should any equipment requiring changes to the electrical design be approved, the required electrical changes shall be made at the expense of the Contractor at no cost to the Owner.

1.6 PRODUCT UNIFORMITY

A. In order to insure an integrated electrical system providing ease of maintenance, operation, and repair, similar types of equipment shall be provided by a single manufacturer. The following categories of equipment shall be provided by a single manufacturer:

1. Electrical distribution equipment consisting of switchboards, switchgear, panelboards, transformers, disconnect switches, and power distribution unit panelboards.
2. Motor controllers and motor control centers.
3. Lamps.
4. Ballasts.
5. Fuses.

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6. Wiring devices.

1.7 PRODUCT INTEGRATION

A. In order to insure an integrated electrical system providing ease of maintenance, operation, repair, and provide integrated control functions and operation, a single Contractor who is regularly engaged in the integration of such systems shall provide the entire system including accessories. Associated equipment specified and allowed to be supplied by other Contractors shall be fully compatible with other components of the system and shall have been demonstrated through actual factory testing. The following categories of equipment shall be provided by a single integrator:

1. Packaged engine generator sets, automatic transfer switches, and control switchgear. The Contractor shall be either the manufacturer of the engine-generator sets or the emergency control and distribution switchgear manufacturer.
2. UPS System and batteries.

1.8 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels shall be as specified in Division 8 of these specifications.

1.9 EXCAVATION AND BACKFILL

A. Provide all necessary excavation and backfill for the installation of electrical work in accordance with Division 2 of these Specifications.

B. Trenches for all underground conduits shall be excavated to the required depths. The bottoms of the trenches shall be tamped hard and evenly graded to assure the conduit is supported for its entire length on solid ground. Should rock be encountered, it shall be removed and backfilled to the proper grade with pea gravel or select fill thoroughly tamped. Conduit laid in trenches dug in fill shall be supported on thoroughly tamped load bearing soil. After the conduits have been inspected and approved by inspecting authorities, the trenches shall be backfilled.

C. Trenches shall be carefully backfilled with select fill material, or pea gravel, to a depth of 6 inches above the top of the conduit. The next layer and subsequent layers of backfill may be excavated materials if of earth, loam, sand or gravel, free of large clods and with rocks no larger than 1-1/2-inch (38-mm) in diameter. Backfill shall be installed in layers 12-inches (300-mm) deep, adequately tamped and wetted down or flushed before the second layer of earth is laid in place.

D. Underground cables or conduits shall be installed in accordance with the National Electrical Code, but in no case shall the buried depth be less than 24-inches (600-mm) below finished grade.

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1.10 OPERATION PRIOR TO COMPLETION

A. When any piece of electrical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, and properly adjust the operation of the equipment before final acceptance by the Owner.

1.11 PROJECT RECORD DOCUMENTS AND RECORDS FOR OWNER

A. Project record documentation and records for the Owner shall be as specified in Division 1, General Requirements Section.

B. In addition to the Division 1 of these specification provide the following minimum items:

1. Operations & Maintenance Manuals: Include, as appropriate to each item, sufficient information to provide for the Owner's operation and maintenance of equipment furnished.
2. As-Builts: Include neatly marked set of reproducible drawings showing "As Installed" work including branch circuiting and circuit designation, feeder identification and wire sizes, location of concealed work, location of wiring devices, underground utilities, and similar items.
3. Contacts: Include with each product, name, address, and telephone numbers, of installing contractor, factory and local service representative.
4. Instructions of Owner's Personnel: Prior to final inspection and acceptance, fully instruct the Owner's designated operating and maintenance personnel in the operating and performance of the equipment furnished.
5. Warranties: Include warranty information properly executed by respective manufacturers, suppliers, or sub-contractors for the equipment and system furnished.

1.12 WARRANTY

A. Project warranty shall be as specified in Division 1, General Requirements Section, but not less than one (1) year from final acceptance.

1.13 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All electrical equipment, belt driven equipment, projecting shafts and other rotating or energized parts shall be properly enclosed or adequately guarded.

1.14 SPACE AND EQUIPMENT ARRANGEMENT

A. Size of equipment shown by the drawings is based on the dimensions of a particular manufacturer. Where other manufacturers are acceptable, it is the responsibility of the contractor to determine if the equipment he proposes to furnish will fit the space.

B. Equipment shall be installed in a manner that will permit access to all surfaces requiring access. Proper clearances shall be maintained to meet all safety and operating requirements or codes and standards.

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1.15 FLOOR, CEILING AND WALL PLATES

A. In finished spaces furnish a chromium plated sectional escutcheon on each conduit penetrating a wall, floor or ceiling. Escutcheons shall be sized to fit snugly to all conduits. Where required, these plates shall be provided with set-screws so that they fit snugly against the finished surface.

1.16 PROTECTION OF MATERIALS AND APPARATUS

A. At all times take such precautions as may be necessary to properly protect the electrical apparatus from damage. This shall include the creation of all required temporary shelters and environmental control to adequately protect any electrical apparatus. Electrical apparatus shall be cribbed up from the floor and covered with protective coverings where necessary to protect the apparatus from damage.

B. As required, apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

C. Damage resulting from failure to comply with this requirement will be considered justification for rejection of the damaged apparatus and requiring its complete replacement by the Contractor.

1.17 INSPECTION OF BUILDING SITE:

A. Contractor shall visit the site, verifying all existing items indicated on plans and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil, conditions, and local requirements. The submission of bids shall be deemed evidence of each visit. All Proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

1.18 ROOF PENETRATIONS:

A. Roof openings shall be made in accordance with Division 7 of these Specifications.

1.19 DEFINITIONS:

A. Approved: As specified or having received Contract Officer’s approval.

B. Furnish: Purchase and deliver to job site.

C. Install: Fix permanently in place and make all necessary connections as related to all trades involved, place in operation, and test.

D. Provide: Furnish and install.

E. Replace: Remove and provide.

F. Relocate: Remove and install in new location.

G. Contractor: Contractor responsible for all trades under the specifications covered by this Division.

H. Work: Labor and/or materials accruing in the provision of a system as defined by the drawings and these specifications.

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I. Store: Provide an environmentally controlled space to protect the stored equipment from damage prior to installation.

J. Remove: De-energize, disconnect, and de-commission the designated equipment as related to the trades required to take the equipment out of service. This shall include transporting the equipment to an off-site location as required by authorities having jurisdiction and regulatory agencies, unless directed otherwise by the Contract Officer.

1.20 ACCEPTABLE MANUFACTURERS

A. Specifications and drawings are intended to indicate a minimum standard of quality for materials and equipment which is established by the listing of manufacturers names and catalog numbers and/or the defining of the technical characteristics in detail or by referenced standards. Materials and equipment that do not comply with these standards of quality will NOT be considered.

B. Contractor shall be responsible to identify any deviation of the submittal from the specified manufacturer, product, equipment or material. Approval by the Contract Officer shall NOT be considered as acceptance of the deviation unless specifically identified and acknowledged by the Contract Officer during the submittal process.

C. Where only one manufacturer's name is listed in the equipment specification, other manufacturers of similar characteristics and of equal or better performance capacities may be considered for "or equal" approval by the Contract Officer. Where more than one manufacturer is listed in the equipment specification, only those named manufacturers will be considered.

D. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended, within the guarantee or warranty period, this material or equipment shall be replaced with the material or equipment specified at no cost to the Owner.

1.21 AVOIDING ELECTROMAGNETIC INTERFERENCE

A. Avoid potential sources of Electromagnetic Interference (EMI) such as motors, transformers, and power wiring when installing raceways for communication and data cabling.

B. To avoid EMI, communication and data cabling pathways should cross perpendicular to fluorescent lighting fixtures and electrical power cables or conduits. As a minimum, communication and data cabling pathways should be provided with at least the following clearances:

1. 48 inches (1200 mm) from motors or transformers
2. 12 inches (300 mm) from conduit and cables used for electrical power distribution including branch circuits.
3. 6 inches (150 mm) from fluorescent lighting fixtures.

1.22 ELECTRICAL PROTECTIVE DEVICE COORDINATION STUDY

A. The Division 16 Contractor shall provide the Electrical Protective Devices Coordination Study (EPDC Study) with protective device settings.

B. General Requirements for EPDC Study. The EPDC Study shall follow ANSI, IEEE, NEMA, NETA, NFPA and UL standards/requirements/procedures and professional engineering practice. The EPDC Study shall be performed and certified by an Electrical Professional Engineer licensed as an individual and as professional firm in the State jurisdiction of the project location. Each submittal of the EPDC Study shall be signed and sealed in accordance with the regulations and rules of the State Board of Professional Engineering.

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C. Electrical Protective Device Coordination Study: The EPDC Study shall be performed using software provided by an approved vendor. Hand calculations and Hand tracings are not allowed nor approved.

1. Time-Current Plots: Provide time-current coordination curves/plots indicating coordination between devices for all electrical service equipment, distribution equipment, and branch circuit equipment. The EPDC Study shall include all equipment including any owner furnished equipment, equipment furnished under other Divisions, including but not limited to Division 14, Division 15 and Division 16. The time-current plots shall indicate the appropriate available fault currents.
2. Table Summary: Protective Device Settings and Fuse Sizes/Types shall be summarized in a Protective Device Setting Table for use by the Division 16 Contractor to set, verify and confirm proper settings available and equipment functions in a coordinate system.
3. Coordination Cases: The EPDC Study shall indicate coordination between three phase, single phase and ground fault systems. The EPDC Study shall be based on a fully rated system.
4. Software: Approved software vendors for the EPDC Study are Easy Power and SKM Systems Analysis, Inc. CAPTOR.
5. Coordination with Equipment: The Contractor and EPDC Study engineer shall coordinate all protective devices provided under all Divisions of the work to ensure proper electrical system coordination is achieve.
6. Equipment Adjustments: The Contractor shall add additional protection options if the supplied equipment characteristics do not conform to system EPDC Study.
7. Submittal: The EPDC shall be submitted with the Switchgear Submittal package. As-Built conditions shall be incorporated in the Record Drawings.

1.23 ELECTRICAL SHORT CIRCUIT STUDY

A. The Division 16 Contractor shall provide the Electrical Short Circuit Study (ESC Study) with short circuit interrupting and withstand ratings for equipment. Short circuit interrupting and withstand ratings are also referred to as the short circuit ratings, withstand ratings, bus bracings, equipment bracings, AIC, KAIC or similar terms in the Project Documents.

B. General Requirements for ESC Study. The ESC Study shall follow ANSI, IEEE, NEMA, NETA, NFPA and UL standards/requirements/procedures and professional engineering practice. The ESC Study shall be performed and certified by an Electrical Professional Engineer licensed as an individual and as professional firm in the State jurisdiction of the project location. Each submittal of the ESC Study shall be signed and sealed in accordance with the regulations and rules of the State Board of Professional Engineering (or similar named authority).

C. Electrical Short Circuit Study: The ESC Study shall be performed using software provided by an approved vendor. Hand calculations are not allowed nor approved.

1. Electrical Short Circuit Criteria: The engineer performing the ESC Study shall confirm in writing with the Power Utility Company the ultimate available short circuit current (which includes all future upgrades) and X/R ratio at the terminals of the Power Utility point of connection. The calculations shall include the estimated motor contribution for motors connected to the system.
2. System Calculations. The ESC Study shall indicate calculated fault calculations for three phase bolted faults, phase-phase (line-line) faults, and phase-ground (line-ground) faults at each connection point, equipment location (referred to as a bus). The ESC Study shall be based on a fully rated system.
3. Equipment: The ESC Study shall include all equipment including any owner furnished equipment, equipment furnished under other Divisions, including but not limited to Division 14, Division 15 and Division 16.
4. Summary Table: ESC Study output shall indicate all faults at each bus and corresponding line flows between buses. All calculations for determining interrupting and withstand ratings shall include a 1.25 multiplier to ensure adequate ratings. All calculated values shall include the 1.25 multiplier value and short circuit interrupting ratings and withstand ratings shall be shall be summarized in a Short Circuit Interrupting and Withstand Table indicating all equipment is suitable rated.
5. Software: Approved software vendors for the ESC Study are Easy Power and SKM Systems Analysis, Inc. DAPPER.

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6. Coordination with Equipment: The Contractor and ESC Study engineer shall coordinate all protective devices and equipment ratings provided under all Divisions of the work to ensure proper electrical system ratings are achieved.
7. Equipment Adjustments: Values of interrupting ratings and withstand ratings indicated in the Project Documents are minimum values and shall not be reduced. However, the Contractor shall increase the Short Circuit Ratings of equipment to match the ESC Study requirements.
8. Submittal: The ESC Study shall be submitted with the Switchgear Submittal package. As-Built conditions shall be incorporated in the Record Drawings.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm) diameter slotted holes at a maximum of 2 inches (50 mm) on centers in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish. SLEEVES

A. Each and every conduit, regardless of material, which passes through a concrete slab (except slab on grade), masonry wall, roof or other portion of the building structure, shall be free from the structure and shall pass through a sleeve.

B. Above grade and dry location sleeves shall be constructed from 20 gauge galvanized steel and shall be flush on both sides of wall surface penetrated. The sleeves shall be sized to allow free passage of the conduit to be inserted, and when this conduit is to be provided with firestopping, the sleeves shall be large enough to pass the conduit and install the necessary firestopping material. Floor sleeves shall extend two (2”) inches above the finished floor slab elevation.

C. Sleeves passing through walls or floors (except slab on grade) at or below finished grade elevation and/or in moist areas shall be constructed of galvanized steel, schedule 40 pipe, and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the conduits have been installed in the sleeves, insure a waterproof penetration by the use of a "Link-Seal" by Thunderline or "Pipe-Linx" by Mason-Dallas, Inc. wall sleeve, or shall fabricate a sleeve in accordance with recommendation and sizing furnished by the Thunderline Corporation or Mason-Dallas, Incorporated.

D. Sleeves passing through fire rated walls or floors shall be sealed with an approved fire-stop material, after installation of the conduit, such that the fire rating of the wall or floor is not degraded.

2.3 IDENTIFICATION

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A. Switchboards, panelboards, transformers, cabinets, and other specified equipment shall be labeled with laminated plates, with 3/8 inch engraved letters. Punch tapes with mastic backings are NOT acceptable.

B. Disconnect switches and other specified equipment shall be marked with laminated plastic plates with 1/4 inch engraved letters. Where individual switches or circuit breakers in power or distribution panelboards do not have cardholders, they shall also be marked with engraved plates.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

D. Where acoustical ceilings and similar finishes will conceal electrical identification markings and devices, coordinate installation of these items before ceiling installation.

E. Underground electrical service entrance conduits and underground main electrical feeders shall be identified by a continuous plastic tape 12 inches (300 mm) below grade in line with the trench. Tape shall be yellow or red with black letters “CAUTION-ELECTRIC LINE BELOW”.

2.4 SERVICES

A. Scope of Work: Furnish all materials and equipment and perform all labor and services necessary to complete the installation of the new electrical service and the installation of underground communication service conduit to the building as indicated by the drawings and as specified herein.

B. Electrical Service: Electrical service equipment shall be of the characteristics, size and capacity indicated by the drawings. The service shall be continuous without splice from the power company connections to the main switchgear and shall be as specified under Division 16 sections specifying raceways and conductors. Primary electrical service shall include the service raceways and fittings required by the power company.

C. Equipment Pads: Concrete pads required for the electrical service shall be provided unless provided by the Power Company. The contractor shall obtain the required information from the Power Company as to the construction of the concrete pad(s).

D. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

E. Meter Sockets: Comply with requirements of electrical power utility company.

F. Communication Service: Service conduit shall be schedule 40 PVC, sized as indicated by the drawings. Elbows shall be PVC coated rigid steel. The exact location and requirements of the communication service conduit terminations shall be verified with the Service Company before installation.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom. In addition, the Contractor shall incorporate the following additional requirements into the project.

1. Shell Areas: Mounting heights of all conduit systems, wiring systems and equipment shall be mounted tight to structure to provide maximum possible headroom for the shell spaces. Contractor shall provide conduit offsets, pull boxes and other equipment to maintain maximum mounting heights and clear spaces in the Shell areas.

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2. If the criteria in this specification are not followed and upon notification by the Contract Officer of a deficiency, the Contractor shall, at not additional cost to the Project, relocate conduits, feeders, branch circuits, disconnects, and other equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 WIRING METHODS

A. Splices and Taps: Installation shall be compatible with conductor material and shall possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Wiring at Outlets: Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.

C. Outlet Locations: The exact location of outlets shall be approved by the Owner, who reserves the right to change the position of any outlet by a distance of 6 feet (1.8 m) in any direction, from the position shown on the drawings, before work is roughed-in, without cost to the Owner. Outlet boxes shall NOT be installed back-to-back in walls.

D. Electrical Capacities: Verify the electrical capacities of all motors and electrical equipment furnished under the other sections of these specifications and install wiring as required to completely connect all equipment requiring electrical power.

E. Control Wiring: Except as otherwise indicated in Division 16, control wiring is provided under Division 15.

F. Power Wiring: Except for such items that are normally wired at their point of manufacture and so delivered and, unless specifically noted to the contrary herein, the Contractor shall do all electric wiring for power supply.

G. Equipment Furnished Under Other Sections: Install all motors, starters, and miscellaneous items of electrical equipment furnished under other sections of these specifications that are not integrally mounted with their equipment. All such equipment shall be securely mounted in a neat and workmanlike manner.

H. Motor Starting Equipment: Except as otherwise indicated in Division 16, all motor starting equipment, will be furnished under Division 15.

I. Termination Lug Sizes and Capacities: The Contractor shall review the entire set of Project Documents, including all Divisions of the Work, for coordination with feeder and branch circuit wring and associated termination lug sizes and capacities for all equipment installed on the Project including Owner Furnished Equipment. The Contractor shall certify by his submittal of electrical, mechanical, plumbing, fire protection, elevator, escalator, kitchen, and other equipment shop drawings or brochures that the Contractor has coordinated all termination requirements. If the Contractor does not coordinate the termination lug sizes and capacities, the Contractor shall be responsible, at no additional cost to the Project, for any revisions, retrofits or upgrades to provide a coordinated wiring system.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials, U-channel system components.

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B. Dry Locations: Steel materials.

C. Selection of Supports: Comply with manufacturer's written instructions.

D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

H. Simultaneously install vertical conductor supports with conductors.

I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

J. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

3.5 FIRESTOPPING

A. Apply firestopping or fireproofing materials to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping or fireproofing materials and installation requirements shall be as specified in Division 7 of these specifications.

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3.6 CONCRETE BASES

A. Construct concrete bases not less than 4 inches (100 mm) larger, around the exposed perimeters, than the supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Concrete strength and reinforcement shall be as specified in Division 3 of these specifications.

3.7 DEMOLITION

A. General: Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Demolished Material: Remove demolished material from Project site in accordance with all applicable codes, standards and regulations.

E. Equipment Relocation: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 FIELD QUALITY CONTROL

A. Inspect installed components for damage or faulty work and repair or replace as necessary. The following minimum items shall be inspected:

1. Raceways and junction boxes.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Concrete bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Refinishing and touchup painting.
8. Firestopping and fireproofing material.
9. Safety guards.
10. Equipment identification.
11. Grounding and lightning protection systems
12. Lighting and lighting control system.
13. Electrical distribution equipment.

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3.10 REFINISHING AND TOUCHUP PAINTING

A. Refinish and Touch Up Paint. Paint materials and application requirements shall be as specified in Division 9 of these specifications.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

3.11 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.12 ELECTRICAL SYSTEMS STUDIES:

A. The Division 16 Contractor shall provide the Electrical System Studies as outline in Part 1 of the Specifications. The Studies shall be organized in a tab binder, with a discussion which includes:

1. Title Sheet Indicating Project Name, Location, Date of Study, and Professional Engineer’s Name and License number, Professional Engineer’s Business Name and Contact Information.
2. Executive Summary.
3. Discussion of Calculation Procedures and Models.
4. Summary of Results.
5. Recommended Revisions.
6. Software Vendor Outputs.
7. Appendix of Backup Materials

B. The Division 16 Contractor shall submit the Electrical System Studies as shop drawing submittal.

C. The Division 16 Contractor shall update any revisions included in the final submittal of the Electrical Studies into the Record Drawings for the Project.

END OF SECTION 260500

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SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

A. Product Data: For each product specified including grounding conductors, clamps and accessories.

1.4 QUALITY ASSURANCE

A. Engage an independent Testing Agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to Authorities Having Jurisdiction. Testing Agency's Field Supervisor shall be a person that is currently certified by the InterNational Electrical Testing Association to supervise on-site testing as herein specified.

B. Provide products specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled" shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

C. Comply with NFPA 780 and UL 96 when interconnecting with the lightning protection system.

D. Comply with applicable Telecommunications Industry Association (TIA) Standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Erico Inc.
b. Burndy Electrical Products.
c. Cadweld
d. Heary Brothers Lightning Protection Co.
e. Lyncole XIT Grounding.
f. O-Z/Gedney Company
g. Thomas & Betts Electrical Products.

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2.2 GROUNDING CONDUCTORS

A. Insulated Conductors: Comply with Division 16 Section "Conductors and Cables."

B. Material: Copper, unless otherwise indicated.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, and stranded, 500MCM minimum, unless otherwise indicated.

G. Bare Copper Conductors: Comply with applicable ASTM Standards for solid, stranded, and tinned conductors.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. General: Comply with IEEE 837 and UL 467 for listed use of specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions. Exothermically welded electrical connections made within existing buildings shall be made with low emission type process, "CALDWELD - EXOLON" or approved equal.

D. Material: All connectors shall be copper or bronze alloy.

2.4 CONDUCTIVITY IMPROVING COMPOUND

A. General: All mechanical or pressure type ground connections shall utilize a conductivity-improving compound between the contact surfaces. This shall include conduit, pipe, or raised floor pedestal connections. Compound shall be an oxide-inhibiting compound with low contact resistance, seal out air and moisture, prevent oxidation or corrosion, improve electrical conductivity and enhance the integrity of the connection.

B. Material: Conductivity improving compound shall be Burndy type PENETROX A, A-13, and E oxide-inhibiting joint compound or approved equal.

2.5 GROUND IMPROVING COMPOUND

A. General: All ground rods and grounding conductors shall be supplemented with an earth resistivity enhancement compound to assure minimum resistance to ground for the grounding system.

B. Material: Compound shall meet all U. S. Environmental Protection Agency requirements and shall be non-decomposing. Enhancement compound shall be Erico "GEM" permanent ground enhancement material, or approved equal.

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2.6 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad 3/4 inch diameter by 120 inches in length (19 by 3000 mm).

B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with non-hazardous chemical salts, and terminated with a 4/0 AWG bare conductor. Provide backfill material recommended by manufacturer.

C. Test Wells: Provide 24 inch long (600 mm) heavy duty high traffic area Schedule 80 PVC test well with cast iron lid and “Ground Rod” identification on the cover.

D. Ground Plates: Copper-clad minimum 12" x 24" x 20 gauge as manufactured by Heary Brothers Model #HB54-C or approved equal. Ground plates shall be provided with two (2) bolt plates, which shall be attached utilizing stainless steel nuts & bolts.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: Provide adequate and permanent equipment grounding in accordance with NFPA 70, and subject to the additional requirements herein specified.

B. Material: Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

C. Protection: Install conductors in raceways for physical protection unless noted otherwise

D. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

E. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

F. Grounding Bus: Install in electrical and communications equipment rooms, in rooms housing service equipment, and elsewhere as indicated. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.

G. Underground Grounding Conductors: Bury at least 30 inches (750 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of an underground duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. General: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Raceways: Install insulated equipment grounding conductors in ALL raceways of ALL systems. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench-tight. Where raceway expansion joints or telescoping joints occur, provide braided bonding jumpers. Provide grounding bushings on all feeder raceways terminating within panelboards and transformers. Install grounding jumpers from these bushings to the equipment ground bus where one occurs or to ground lugs mounted to the frame of the enclosures.

C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the

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switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide 500MCM minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Terminate grounding conductor on ground bus and extend No. 4 AWG grounding conductor to each cabinet grounding terminal on the equipment.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

I. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 COUNTERPOISE

A. Ground the steel framework and the below grade rebar cage of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 100 feet (30 m) apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod to each steel column, and to the below grade rebar cage, extending around the perimeter of the building. Use tinned-copper conductor not less than 500MCM for counterpoise and for tap to building steel. Bury counterpoise not less than 30 inches (750 mm) below grade and 24 inches (600 mm) from building foundation.

3.4 INSTALLATION

A. Ground Rods: Drive ground rods until tops are 2 inches (50 mm) below finished floor or below final grade, unless otherwise indicated. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating. Driven ground rods shall be used for all electrode locations. In the event that the ground rods can not be driven (i.e., due to rock), inform the Contract Officer's Representative immediately. At the recommendation of the Contract Officer's Representative, ground plates, shall be substituted in place of the ground rods.

B. Ground Improving Compound: Ground improving compound shall be installed per manufacturer's recommendations. Ground rods shall be installed in minimum 3" diameter augured hole with ground improving compound installed for the entire depth of the ground rod. Grounding conductors shall be installed in 4" wide trench with ground improving compound installed minimum 1" thick on the top and bottom of the

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grounding conductor.

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

E. Metal Domestic Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

G. Gas Piping: Where applicable, bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Test Wells: Install one test well for each service at the ground rod electrically closest to the service entrance and at the main grounding electrode. Set top of well flush with finished grade or floor.

I. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70 using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4/0 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.5 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are NOT acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Non-Contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond elec-

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trically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use bolted pressure clamps with at least two bolts. Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Torque: Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in applicable UL Standards.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.6 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency, as herein specified, to perform the field quality control testing of the grounding systems as herein specified.

B. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with the Project requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method and two-point method both according to IEEE 81.
3. Perform ground continuity tests between the main ground system and equipment frames, the system neutral, and derived neutral points. This test shall be made passing a minimum or 10-amp DC current between the ground reference system and the ground point to be tested. Voltage drop shall be measured and resistance shall be calculated by voltage drop method.
4. Perform earth resistivity test using the four-terminal method to determine the average soil resistivity at the location of the main grounding electrode. Earth resistivity shall be given in ohm-centimeter.
5. Provide drawings locating each ground rod, ground bus, ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

    a. Equipment Rated 500 kVA and Less: 10 ohms.
    b. Equipment Rated over 500 kVA: 5 ohms.
    c. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    d. Manhole Grounds: 10 ohms.
    e. Signal and Communications Grounds: 2 ohms.

6. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Contract Officer promptly and include recommendations to reduce ground resistance.

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3.7 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 16060

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SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to provide labeling and identification as specified herein and to comply with applicable ANSI and OSHA standards as follows:

1. Raceways and cables
2. Equipment nameplates
3. Underground lines warning tape
4. Circuits over 600 volts
5. Systems identification
6. Circuit identification on boxes
7. Conductors under 600 volts
8. Power circuit identification
9. Conductor identification
10. Warning and Instructional signs.

B. Color and legends used for identification in existing buildings shall match existing identification methods provided that they comply with current OSHA and ANSI Standards.

1.3 SUBMITTALS

A. Product: For each electrical identification product indicated, submit product data and procedures used.

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Company
2. Ideal Industries
3. Panduit Corporation
4. Seaton

1.5 QUALITY ASSURANCE

A. Comply with applicable OSHA, ANSI, UL and NFPA Standards.

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PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

A. General: Comply with applicable OSHA and ANSI standards for minimum size of letters for legend and for minimum length of color field for each raceway and cable size. Labels shall be black letters on orange field indicating the voltage and feeder designation.

B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).

E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape, not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick), with a printed legend indicating type of underground line.

F. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch (0.4-mm) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

G. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

H. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

I. Brass or Aluminum Tags: 2 by 2 by 0.05-inch (51 by 51 by 1.3-mm) metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with OSHA Regulations.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes. Nameplates shall be punched or drilled for mechanical fasteners.

C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

D. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat lock washers.

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2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: According to color-coding.

B. Metal Rings: Embossed-brass, with metal hook type mounting strap.

1. Minimum Diameter: 1 inch (26 mm).
2. Minimum Size Lettering: 3/16 inch (5 mm).

C. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
2. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
3. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
4. Self-Adhesive Identification Products: Clean surfaces before applying.
5. Painted Identifications: Install painted identification according to manufacturer's written instructions and as follows:

    a. Clean surfaces of dust, loose material, and oily films before painting.
    b. Prime surfaces using type of primer specified for surface.
    c. Apply one intermediate and one finish coat of enamel.

B. Circuits over 600 Volts: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:

1. Provide orange color adhesive vinyl labels to identify electrical power, lightning and control conduits. Place label at load source and at intermediate points at 50’ intervals. Label should describe type of service, such as voltage, power, lighting, control, etc.
2. Paint fire alarm boxes red.
3. Paint Emergency System wiring boxes yellow.

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C. Systems Identification: Provide Color Banding of Raceways and Exposed Cables of the systems listed below:

1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
3. Apply the following colors to the systems listed below:

    a. Fire Alarm System: Red.
    b. Fire-Suppression Supervisory and Control System: Red and yellow.
    c. Combined Fire Alarm and Security System: Red and blue.
    d. Security System: Blue and yellow.
    e. Mechanical and Electrical Supervisory System: Green and blue.

D. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

E. Circuit Identification Labels:

1. Boxes and Cover Plates: Label with permanent marking pen on top of junction box covers and on back of outlet box cover plates.
2. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
3. Provide wire markers with metallic tracer wire with circuit number on each conductor in splice box, pull box and first load connection on home run.

F. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

G. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.

1. Color-code 208/120-V system as follows:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
    d. Neutral: White.
    e. Ground: Green.
    f. Isolated Ground: Green with yellow stripe

2. Color-code 480/277-V system as follows:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.
    d. Neutral: Gray.
    e. Ground: Green.

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

    a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150

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mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch (25-mm) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

H. Power-Circuit Identification, over 600 Volts: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchgear rooms.

1. Legend: 1/4-inch (6.4-mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.
3. Band Fasteners: Integral ears.

I. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits that are served from more than one source and installed in the Same Enclosure: Identify each conductor with source and circuit number. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

J. Apply warning, caution, and instruction signs where indicated by the drawings or required by code in equipment rooms and on equipment as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch (9-mm) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

K. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems. Unless otherwise indicated, provide a single line of text with 1/2-inch (13-mm) high lettering on 1-1/2-inch (38-mm) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use white lettering on black field for normal power systems and white lettering on red field for emergency systems. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures.
2. Transformers.
3. Switchgear and switchboards.
4. Emergency system boxes and enclosures.
5. Disconnect switches.
6. Enclosed circuit breakers.
7. Motor starters and controllers.
8. Ground Bars.
9. Motor-control centers.
10. Electrical substations.
11. Power-generating units.
12. Power transfer equipment.
13. UPS Systems.
14. Battery racks.
15. Contactors.
16. Push-button stations.

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17. Remote-controlled switches.
18. Dimmers.
19. Control devices.
20. Access doors and panels for concealed electrical items
21. Inverters.
22. Rectifiers.
23. Clock/program master equipment.
24. Call system master station.
25. TV/audio-monitoring master station.
26. Fire alarm master station or control panel.
27. Security-monitoring master station or control panel.

END OF SECTION 16075

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SECTION 16110 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. Rigid Metal Conduit (RMC).
b. Intermediate Metal Conduit (IMC).
c. PVC externally coated IMC.
d. Electrical Metallic Tubing (EMT).
e. Flexible Metal Conduit (FMC).
f. Liquidtight Flexible Metal Conduit (LFMC).
g. Rigid Nonmetallic Conduit (RNC).
h. Wireways.
i. Surface raceways.

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes.
b. Floor boxes.
c. Outlet boxes.
d. Pull and junction boxes.
e. Cabinets and hinged-cover enclosures.

1.3 SUBMITTALS

A. Product Data: For conduits, fittings, expansion joints assembly, through-wall and floor seals assembly, surface raceways, wireways, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Provide layout drawings showing conduit routing drawings, sections, elevations, and details. Include all pullboxes, manholes, expansion fitting and supports.

1.4 QUALITY ASSURANCE

A. Listed and Labeling: Provide products specified in this Section that are listed and labeled. The Terms “Listed” and “Labeled” shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

B. Standards: Comply with applicable UL and NEMA Standards. Comply with NECA's "Standard of Installation."

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1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. Alflex Corp.
b. Anamet, Inc.; Anaconda Metal Hose.
c. Anixter Brothers, Inc.
d. Carol Cable Co., Inc.
e. Cole-Flex Corp.
f. Electri-Flex Co.
g. Flexcon, Inc.; Coleman Cable Systems, Inc.
h. Grinnell Co.; Allied Tube and Conduit Div.
i. Monogram Co.; AFC.
j. Spiraduct, Inc.
k. Triangle PWC, Inc.
l. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:

a. Anamet, Inc.; Anaconda Metal Hose.
b. Arnco Corp.
c. Breeze-Illinois, Inc.
d. Cantex Industries; Harsco Corp.
e. Certainteed Corp.; Pipe & Plastics Group.
f. Cole-Flex Corp.
g. Condux International; Electrical Products.
h. Electri-Flex Co.
i. George-Ingraham Corp.
j. Hubbell, Inc.; Raco, Inc.
k. Lamson & Sessions; Carlon Electrical Products.
l. R&G Sloan Manufacturing Co., Inc.
m. Spiraduct, Inc.
n. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.
b. Crouse-Hinds; Div. of Cooper Industries.
c. Emerson Electric Co.; Appleton Electric Co.
d. Hubbell, Inc.; Killark Electric Manufacturing Co.
e. Lamson & Sessions; Carlon Electrical Products.
f. O-Z/Gedney; Unit of General Signal.
g. Scott Fetzer Co.; Adalet-PLM.
h. Spring City Electrical Manufacturing Co.

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4. Metal Wireways:

   a. Hoffman Engineering Co.
   b. Keystone/Rees, Inc.
   c. Square D Co.

5. Nonmetallic Wireways:

   a. Hoffman Engineering Co.
   b. Lamson & Sessions; Carlon Electrical Products.

6. Surface Metal Raceways:

   a. Airey-Thompson Co., Inc.; A-T Power Systems.
   b. American Electric; Construction Materials Group.
   c. Butler Manufacturing Co.; Walker Division.
   d. Wiremold Co. (The); Electrical Sales Division.

7. Surface Nonmetallic Raceways:

   a. Anixter Brothers, Inc.
   b. Butler Manufacturing Co.; Walker Division.
   c. Hubbell, Inc.; Wiring Device Division.
   d. JBC Enterprises, Inc.; Enduro Fiberglass Systems.
   e. Lamson & Sessions; Carlon Electrical Products.
   f. Panduit Corp.
   g. Thermotools Co.
   h. United Telecom; Premier Telecom Products, Inc.
   i. Wiremold Co. (The); Electrical Sales Division.

8. Boxes, Enclosures, and Cabinets:

   a. American Electric; FL Industries.
   b. Butler Manufacturing Co.; Walker Division.
   c. Crouse-Hinds; Div. of Cooper Industries.
   d. Electric Panelboard Co., Inc.
   e. Erickson Electrical Equipment Co.
   f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
   g. Hubbell Inc.; Killark Electric Manufacturing Co.
   h. Hubbell Inc.; Raco, Inc.
   i. Lamson & Sessions; Carlon Electrical Products.
   j. O-Z/Gedney; Unit of General Signal.
   k. Parker Electrical Manufacturing Co.
   l. Robroy Industries, Inc.; Electrical Division.
   m. Scott Fetzer Co.; Adalet-PLM.
   n. Spring City Electrical Manufacturing Co.
   o. Thomas & Betts Corp.
   p. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING

A. General: UL-Listed conduit and tubing with material herein specified shall comply with applicable NEMA and ANSI Standards.

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B. EMT Fittings: EMT fittings shall be set-screw or compression type for telephone system raceway other then telephone service. Fitting for power, lighting or control circuits shall be compression type.

C. Material: Aluminum or zinc-coated steel.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Expansion joints: Equal with O-Z Gedney type “AX-8” with external bonding jumper type “BJ” for IMC and “TX” for EMT.

F. Moisture Sealing: Sealing assembly around conduits passing through concrete wall or floor equal with O-Z Gedney type “FSK”.

2.3 NONMETALLIC CONDUIT AND TUBING

A. General: UL-Listed non-metallic conduit and tubing with material herein specified shall comply with applicable NEMA and ANSI Standards.

B. Type: Non-metallic conduit and tubing shall be Schedule 40, PVC.

C. Fittings: Matched to conduit or tubing type and material.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Standard covers shall be hinged type unless noted otherwise. Provide flanged and gasketed type covers when required by the application or installation.

D. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captivated screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

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B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

C. Accessories: Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.7 OUTLET, DEVICE, PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: UL-Listed, galvanized steel metal boxes shall comply with applicable NEMA and ANSI Standards.

B. Cast-Metal Outlet Boxes: UL-Listed, Type FD, cast box with gasketed cover.

C. Cast-Metal Boxes: UL-Listed cast aluminum with gasketed cover.

2.8 FLOOR BOXES

A. Floor Boxes: Cast metal, fully adjustable, rectangular.

B. Type: Provide one-gang, two-gang, or three-gang, as required with isolation barriers between communication and power section, equal to Walker 880CS Series.

C. Cover: Provide brass with combination carpet or tile fitting as required to be compatible with the finished floor material.

2.9 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: Enclosures shall be UL-Listed, comply with applicable NEMA and ANSI Standards, and provided with continuous hinge cover and flush latch. Provide galvanized steel with manufacturer's standard enamel finish inside and out.

B. Cabinets: Cabinets shall be UL-Listed, comply with applicable NEMA and ANSI Standards. Provide galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

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1. Exposed: RMC, IMC or EMT.
2. Concealed: RMC, IMC or EMT.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
7. Roof and Truck docks: RMC or IMC.

B. Indoors: Use the following wiring methods:

1. Exposed: EMT.
2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC except in wet or damp locations, use LFMC.
4. Medium Voltage: IMC
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1.
7. Damp or Wet Location Boxes and Enclosures: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum raceway size for home runs shall be 3/4-inch trade size.

C. Conceal raceway, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes.

E. Install raceways level and square, at proper elevations, and with adequate headroom.

F. Use temporary closure devices to prevent foreign matter from entering raceways.

G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of conduit bend is not visible above the finished slab.

H. Make bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

I. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

J. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

K. Raceways embedded in slabs shall be Installed in middle third of slab thickness where practical and only where approved by the Structural Engineer. Leave minimum 1-inch (25 mm) concrete cover. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in concrete. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Transition from nonmetallic tubing to rigid steel conduit, or IMC before rising above floor.

L. All underground change of directions shall be made with factory applied PVC coated rigid or factory ap-

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plied PVC coated IMC steel elbows.

M. Installs exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical. Run parallel or banked raceways together, on common supports where practical. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

N. Join raceways with fittings designed and approved for the purpose and make joints tight. Make raceway terminations tight and use insulating bushings to protect conductors.

O. Tighten set-screws of threadless fittings with suitable tools.

P. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with a single locknut, use multiple locknuts (i.e., one inside and one outside the box).

Q. Where EMT enters a box, the joint between the connector and the box shall be made tight, in an approved manner, by a steel compression fitting with an insulated throat device.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90 kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

T. Install telephone and signal system raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.

V. At stub-up connections extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Use maximum of 6 feet (1830 mm) of flexible conduit for connection to recessed and semi-recessed lighting fixtures. Use maximum of 2 feet of flexible conduit for connection to equipment subject to vibration, noise transmission, or movement, and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections

X. Do not install aluminum conduits embedded in or in contact with concrete.

Y. Provide expansion joints assembly to accommodate the structural expansion joints as defined on the Architect’s and Structural Engineer’s drawings.

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Z. Surface raceways shall have installed a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

AA. Set floor boxes level and adjust to finished floor surface.

BB. Install hinged-cover enclosures and cabinets plumb, and properly support at each corner.

CC. The installation of metallic conduits shall result in the conduit being used as an equipment grounding conductor in accordance with Article 250 of the latest edition of the National Electrical Code.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. Upon completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.6 SEGREGATION OF WIRING SYSTEMS

A. The use of common pullboxes, wireways, cabinets or any other type of enclosure shall not compromise segregation of wiring systems. UPS circuits, emergency circuits, or normal circuits shall not share common raceway systems with circuits from other systems. The raceway system for each feeder shall be a separate system completely fault isolated from all other raceways systems. Branch circuits from different panelboards shall not share common raceways or common pullboxes with branch circuits from other panelboards.

END OF SECTION 16110

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SECTION – 16120 CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables with associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Product data for wire, cable, connectors, and conductor splices.

1.4 QUALITY ASSURANCE

A. Provide wires and cables specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled" shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

B. Comply with the current edition of NFPA 70 or the edition adopted by local Authorities with amendments where applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle wires and cables according to applicable NEMA standards.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations as required to suit field conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements herein specified and as approved by the Authority Having Jurisdiction. Provide products by one of the following:

1. Wires and Cables:

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a. Alcan Aluminum Corporation; Alcan Cable Div.
b. Carol Cable Co., Inc.
c. Senator Wire & Cable Company.
d. Southwire Company.
e. Okonite Company
f. Perilli Cables North America

2. Metal Clad Cables:

a. Alcan Aluminum Corporation; Alcan Cable Div.
b. AFC Cable Systems
c. Southwire Company.
d. Okonite Company
e. Perilli Cable North America

3. Connectors for Wires and Cables:

a. AMP Incorporated.
b. General Signal; O-Z/Gedney Unit.
c. Monogram Co.; AFC.
d. Square D Co.; Anderson.
e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. General: UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified herein shall comply with applicable NEMA standards.

B. Conductor Material: Copper 98% minimum conductivity, soft-drawn annealed.

C. Stranding: Stranded conductor for No. 12 AWG and larger.

D. Control wire: Copper stranded only.

E. Metal Clad Cable (MC): Cable shall be two or more factory assembled insulated conductors and an insulated green wire ground enclosed in a metallic sheath of interlocked galvanized steel strip in accordance with UL Standard 1569. The insulated conductors shall have a minimum operating temperature of 90°C and shall meet all other requirements herein specified.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as herein specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

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3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type THWN, in raceway.

B. Service Entrance: Type XHHW-2 in raceway.

C. Feeders: Type THHN/THWN, in raceway.

D. Underground Feeders: Type XHHW-2, 90°C insulation.

E. Fire-Pump Feeder: Same as specified for service entrance.

F. Branch Circuits: Type THHN/THWN, in raceway, or Tyre McCable

G. Branch Circuits: If approved by the Authority Having Jurisdiction MC Cable may be used but shall be limited to branch circuit wiring to lighting fixture and convenience receptacle installations within wall cavities or above the ceilings. Type MC cable shall be installed in a neat workmanlike manner, shall not be installed for home runs, shall not be installed exposed to view within finished areas, and shall not be installed within electrical or mechanical equipment rooms.

H. Class 1 Control Circuits: Type THHN/THWN, in raceway.

I. Class 2 Control Circuits: Power-limited tray cable, in cable tray.

J. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

K. Class 2 Control Circuits: Type THHN/THWN, in raceway for smoke control systems.

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Before wire is pulled into conduit, the conduit shall be thoroughly swabbed in such a manner as to remove all foreign material, and to permit the wire to be pulled into a clean dry conduit.

D. Minimum wire size for branch circuits shall be No. 12 AWG. Minimum wire size for control circuits shall be No. 12.

E. Use manufacturer-approved pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

F. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

H. Unless larger sizes are indicated otherwise on the contract drawings, provide No. 10 AWG conductors for 20 Amp, 120 Volt branch circuit homeruns longer than 60 feet and No. 8 AWG conductors for 20 Amp, 120 Volt branch circuit homeruns longer than 120 feet.

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I. Unless larger sizes are indicated otherwise on the contract drawings, provide No. 10 AWG conductors for 20 Amp, 277 Volt branch circuit homeruns longer than 150 feet and No. 8 AWG conductors for 20 Amp, 277 Volt branch circuit homeruns longer than 300 feet.

J. Unless noted otherwise, branch circuit wiring may be combined into a single raceway in accordance with the NEC provided the conductors are properly derated. All neutral conductors shall be considered current carrying conductors. The maximum number of circuits that can be combined into a single raceway is six (6).

K. Telecommunications Cable Support Installation shall be installed in open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable's weight. These types of supports shall be used to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports shall be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.4 CONNECTIONS

A. No splicing or joints will be permitted in branch circuits except at outlets or accessible junction boxes. Service and feeders shall run their entire length without joints or splices

B. In the making of a splice, connectors shall be brought up securely upon the conductors in such a way that all conductors are equally engaged, the insulation is not ruptured and no bare wires are exposed or have "backed-off" due to the application of pressure.

C. Screw-on pigtail connectors may be used for splicing wire up to and including No. 8 AWG. Wires shall be twisted together with a minimum of one turn of the stripped conductors before insertion into connectors. Connectors shall be installed so that the conductor is fully insulated by a skirt, or taped in such a manner that cold flow of the insulation will not be induced when the conductor is positioned in its final operational position.

D. Terminations or splices for copper conductors No. 6 AWG and larger shall utilize hydraulically crimped copper crimp connectors UL approved for the application in which they are used. Crimped connectors shall be applied using only tooling specifically recommended by the connector manufacturer, and tooling shall not release the connector until proper crimping force has been achieved. Where 3 or more conductors are installed in wiring gutter, utilize a screw type Power Distribution Block.

E. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

F. Use splice and tap connectors compatible with conductor material.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

END OF SECTION 16120

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SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. IG: Isolated Ground.

C. WP: Weather Proof.

D. SPST: Single Pole Single Throw.

1.4 QUALITY ASSURANCE

A. Listed and Labeling: Provide products specified in this Section that are listed and labeled. The Terms “Listed” and “Labeled” shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

B. Standards: Comply with applicable UL and NEMA Standards for materials, sizes, and configurations.

1.5 SUBMITTALS

A. Product Data: For each product specified including receptacles, switches, coverplates, dimmers, and accessories.

B. Samples: Samples of pertinent products shall be submitted for approval as required by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices:

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a. Hubbell, Inc.; Wiring Devices Div.
b. Pass & Seymour/Legrand; Wiring Devices Div.
c. Leviton Manufacturing Co., Inc.

2. Wiring Devices for Hazardous (Classified) Locations:

a. Crouse-Hinds Electrical Co.; Distribution Equipment Div.
b. Killark Electric Manufacturing Co.
c. Pyle-National, Inc.; an Amphenol Co.

3. Wall Box Dimmer Switches:

a. Lutron.
b. Lightolier.
c. Leviton Manufacturing Co., Inc.

2.2 RECEPTACLES

A. Standard wall receptacles shall be equal to Leviton #5362, 20 amperes, 120 volts, duplex, grounding type, except where indicated otherwise on the drawings.

B. Ground Fault Circuit Interrupters (GFCI) with lockout self-diagnostic shall be equal to Leviton #8899.

C. Isolated-Ground (IG) receptacles shall be equal to Leviton #5362-IG. Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap. Isolation method shall be integral to receptacle construction and not dependent on removable parts.

D. Weatherproof Receptacles (WP) shall be equal to the standard GFCI receptacle listed above with weatherproof cover. Covers for vertically mounted receptacles shall be equal to Leviton #4992 while covers for horizontally mounted receptacles shall be equal to Leviton #4990.

E. Permanent Weatherproof Receptacles shall be equal to standard GFCI receptacle listed above with weatherproof cover equal to Leviton #5977 for vertical mounting and Leviton #5997 for horizontal mounting.

F. Decorative area wall receptacles shall have square Decora style face, 20 amperes, 120 volts, duplex, grounding type, equal to Leviton #16362 or #16362-IG as required.

2.3 SWITCHES

A. Snap switches shall be flush tumbler rated at 20A, 120/277 volts unless specifically shown to be controlled in some other fashion.

1. Switches shall be SPST, 3-way, 4-way, as indicated equal to Leviton #1221-2, #1223-2 or #1224-2 as required.

2. Switches with pilot lights shall be SPST, Double-Throw, or 3-way as indicated equal to Leviton #1221-PLR, #1222-PLR or #1223-PLR as required.

3. Switches with locking type features shall be SPST, 3-way or 4-way as indicated equal to Leviton #1221-2L, #1223-2L or #1224-2L as required.

2.4 WALL BOX DIMMER SWITCHES

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A. Dimmer Switches shall be modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.

1. Control shall be continuously adjustable slide. Single-pole or three-way switch to suit connections.
2. Incandescent Lamp Dimmers shall be modular, 120 V, 60 Hz single pole with electromagnetic filter to eliminate noise, RF, and TV interference equal to Lutron “Nova T” series and meet UL-20.
3. Fluorescent Lamp Dimmers shall be modular, compatible with dimmer ballast; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness. Fluorescent Lamp Dimmers shall be equal to Lutron “Nova T” Series.
4. Dimmer should be equal to Lutron “Nova” series slide off dimmers for single control locations and Lutron “maestro” series for 3 way dimming applications.

2.5 FINISHES

A. All wiring devices in finished areas shall be furnished in colors and with device plates of colors in nylon as selected by the Architect. Generally, utility areas and unfinished spaces shall be stainless steel Type 302 cover plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. All dimmer circuits shall have a dedicated neutral conductor for each dimmer load circuit on the line and load side of the dimmer. Do not share neutral conductor for dimmers.

E. Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top or right side.

F. Group adjacent switches under single, multigang wall plates.

G. Lighting control switches shall be installed 48” above the finished floor to the centerline of the switch unless specifically noted otherwise on the drawings.

H. Convenience receptacles and communication outlets shall be installed 18” above the finished floor to the centerline of the outlet unless specifically noted otherwise on the drawings.

I. GFCI receptacles shall have dedicated branch circuits.

J. Where dimmers and switches are shown adjacent, they shall be mounted under a common coverplate and shall match in style.

3.2 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

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B. IG receptacles shall be connected to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturers torque values are not indicated, use applicable UL standards.

D. Connect wiring device using screw terminals only. Do not back wire between devices.

3.3 CLEANING

A. Clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

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SECTION 16475 - SAFETY SWITCHES, FUSES, AND ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes individually mounted safety switches and enclosed circuit breakers used for the service disconnect switches, feeder and equipment disconnect switches, feeder and branch-circuit protection, and motor disconnect switches.

1.3 SUBMITTALS

A. Product Data: For each product specified including disconnect switches, enclosed circuit breakers, fuses, and accessories.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches and enclosed circuit breakers from one source and by a single manufacturer.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled" shall be as defined in the NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction and marked for the intended use.

C. Standards: Comply with applicable NEMA and UL Standards.

1.5 COORDINATION

A. Coordinate layout and installation of safety switches, enclosed circuit breakers, and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide disconnect switches and fuses by one of the following:

1. Fusible Switches:

a. Eaton Corp.; Cutler-Hammer Products.

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b. General Electric Co.; Electrical Distribution and Control Division.
c. Siemens Energy & Automation, Inc.
d. Square D Corp.; Groupe Schneider

2. Fuses:

a. Bussmann
b. Gould-Shawmut
c. Littlefuse

3. Enclosed Circuit Breakers:

a. Eaton Corp.; Cutler-Hammer Products
b. General Electric Co.; Electrical Distribution and Control Division.
c. Siemens Energy & Automation, Inc.
d. Square D Corp.; Groupe Schneider

2.2 DISCONNECT SWITCHES

A. Enclosed, Fusible Switch: NEMA Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located.

B. Disconnect Switch Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Handle: Lockable with two padlocks and interlocked with cover in CLOSED position.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
3. Auxiliary Switch: One single-pole-double-throw (SPDT) switch with “a” and “b” contacts; “a” contacts mimic circuit breaker contacts, “b” contacts operate in reverse of circuit breaker contacts.

2.3 FUSES

A. Main Service: Class L, fast acting.

B. Main Feeders: Class J, time delay.

C. Motor and Transformer Branch Circuits: Class RK1, time delay.

D. Other Branch Circuits: Class RK5, non-time delay.

2.4 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1 with interrupting capacity to meet available fault currents and lockable with two padlocks. Molded-case circuit breakers shall be thermal-magnetic with inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 200 amperes and larger.

B. Molded-Case Circuit Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Shunt Trip: 120 V trip coil energized from separate circuit.
3. Auxiliary Switch: One single-pole-double-throw (SPDT) switch with “a” and “b” contacts; “a” contacts mimic circuit breaker contacts, “b” contacts operate in reverse of circuit breaker contacts.

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2.5 ENCLOSURES

A. Applicable NEMA standards to meet environmental conditions of installed location.

1. Indoor Locations: NEMA, Type 1
2. Outdoor Locations: NEMA, Type 3R.
3. Kitchen Areas: NEMA, Type 4X, and stainless steel.
4. Other Wet or Damp Indoor Locations: NEMA, Type 4.
5. Hazardous Areas: NEMA, Type suitable for the Division, Class, and Group of the hazardous environment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches and circuit breakers level and plumb in locations as indicated, according to manufacturer's written instructions, and with proper working clearances.

B. Connect disconnect switches circuit breakers, and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in applicable UL Standards.

C. Identify each disconnect switch or enclosed circuit breaker according to requirements specified in other Division 16 Specification Sections.

D. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

E. Install typewritten labels on the inside door of each fused switch to indicate fuse replacement information including fuse classification, ampacity, and manufacturer’s part number.

3.2 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

3.3 ACCESSORIES

A. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

B. Cabinet: Wall-mounted, 0.05-inch (1.27-mm) thick steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.

1. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch (40-mm) letters on door.
4. Fuse Pullers: For each size fuse.

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C. Chart: Furnish a fuse chart affixed to the inside of the spare fuse cabinet indicating the fuse classification, ampacity, and manufacturer's part number of the fusing for each piece of equipment.

END OF SECTION 16475

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SECTION 16510 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.
2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
3. Catalog cut sheets for each fixture type including complete photometric data in IES format.
4. Emergency lighting unit battery and charger.
5. Fluorescent and high-intensity-discharge (HID) ballasts..
6. Types of lamps.
7. Electronic ballast warranty and applicable combined lamp/ballast warranty.
8. Submit catalog cut sheets for photocells, occupancy sensors, dimming components, time clocks and lighting contactors.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Samples for Verification: For lighting fixtures designated for sample submission in the Interior Lighting Fixture Schedule.

1. Lamps: Specified units installed.
2. Ballast: 120-V model of specified ballast type.
3. Accessories: Cord and plug.

1.4 QUALITY ASSURANCE

A. Listed and Labeling: Provide products specified in this Section that are listed and labeled. The Terms “Listed” and “Labeled” shall be as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

B. Standards: Comply with applicable NEMA, IEEE, UL and NFPA Standards.

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C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, provide one manufacturer of the products indicated for each designation in the Lighting Fixture Schedule shown on the Drawings.

1. Lamps:

a. General Electric Lighting
b. Osram Sylvania Lighting
c. Phillips Lighting
d. Venture Lighting

2. Ballasts:

a. Advance
b. MagneTek/GE
c. Motorola
d. Osram Sylvania Lighting
e. Venture

3. Dimming Ballasts:

a. Lutron
b. Motorola
c. Osram Sylvania Lighting

2.2 FIXTURES AND FIXTURE COMPONENTS

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Verify that there is no other point of lamp contact to the fixture other than the lamp base to the lamp socket.

E. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.

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3. Diffusing Specular Surfaces: 75 percent.

F. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

G. Air-Handling Fixtures: For use with plenum ceiling for air return and heat extraction.

1. Air-Movement Performance Requirements: Certified according to ADC.
2. Heat Removal Units: An air path through lamp cavity.
3. Static Fixtures: Supply slots are blanked off, and fixture appearance matches active units.

2.3 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output and lamp life.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Sound Rating: A.
4. Ballasts for lamps of T5, T4, or T2 diameter shall contain dynamic end-of-lamp-life sensing circuitry.
5. Coordinate lamp and ballast compatibility with manufacturers.

B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Certified Ballast Manufacturer Certification: Indicated by label.
2. Encapsulation: Without voids in potting compound.
3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
4. High power factor: Greater than 95%.
5. Ballast shall have inrush current limiting circuitry to assure compatibility with all lighting system controls.
6. Ballast shall provide lamp starting conditions and operating parameters consistent with lamp manufacturer's recommendations.
7. Ballast shall be instant start, or programmed start without continuous cathode heating, for maximum efficiency.
8. The electronic ballast shall be Underwriters laboratories (UL) listed, Class P, Type 1 outdoor rated, CSA certified and manufactured in accordance with ANSI methods where applicable.
9. Ballast shall comply with applicable ANSI and IEEE standards for harmonic distortion and line voltage transient protection, and be immune to electrical disturbances.
10. Integral leads on ballasts shall be color-coded to applicable ANSI standards.
11. T8 instant start ballasts shall be parallel wired, THD<10%, minimum starting temperature of 0 Deg. F., maximum case temperature of 70 Deg. C., and allow for remote mounting up to 18 feet. Ballast factor to be [0.88-0.90 for normal light output] [0.77 for low light output] [1.18-1.20 for high light output].
12. T8 rapid start ballasts shall be series wired, THD<10%, minimum starting temperature of 0 Deg., maximum case temperature of 70 Deg. C., and allow for remote mounting up to 18 feet. Ballast factor shall be [0.88 for normal light output] [0.74 for low light output] of T8 lamps. Ballast shall provide 50,000 or better switching cycles for use on occupancy sensors and build control systems.
13. T5 program start ballasts shall be series wired, THD<10%, minimum starting temperature of 0 Deg. F., maximum case temperature of 70 Deg. C., and allow for remote mounting up to 18 feet. Ballast factor shall be 1.00 for normal light output of T5 lamps. Ballasts shall provide up to 100,000 switching cycles for use on occupancy sensors and building control systems. Ballast shall provide dynamic and end-of-life sensing with auto-reset feature when lamps are replaced.

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C. Electromagnetic Ballasts for other Linear and U-Bent Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Type: Energy saving.
2. Certified Ballast Manufacturer Certification: Indicated by label.
3. Encapsulation: Without voids in potting compound.
4. Electromagnetic ballasts installed outdoors shall be low temperature rated.

D. Ballasts for Compact Fluorescent Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Type: Electronic or electromagnetic, fully encapsulated in potting compound.
2. Power Factor: Electronic-97% minimum and electromagnetic-90 % minimum.
3. Operating Frequency: Electronic-20 kHz or higher and electromagnetic-60 Hz.
4. Flicker: Less than 5 percent.
5. Lamp Current Crest Factor: Less than 1.7.
6. Compact fluorescent ballasts shall be series wired, THD<10%, minimum starting temperature of 0 Deg. F., maximum case temperature of 70 Deg. C., and allow for remote mounting up to 18 feet. Ballast factor shall be 0.95-1.05 for normal light output. Ballast input voltage shall be universal voltage (120 volts through 277volts).

E. Ballasts for Dimmer-Controlled Fixtures: Comply with general and fixture-related requirements above for electronic ballasts.

1. Compatibility: Certified by manufacturer for use with specific dimming system indicated for use with each dimming ballast.
2. Power Factor: Designed with high power factor (greater than 0.90), continuous dimming to levels indicated on the Drawings, high power factor throughout the entire dimming range, ANSI cathode voltage, and EMI/RFI shielding.
3. Ballasts shall have anti-flash circuitry that will start the lamp in any level mode without flashing to full light output. Light level output shall be continuous, even and flicker free over the entire dimming range.

F. Ballasts for Low-Temperature Environments: As follows:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Above: Electronic or electromagnetic type rated for 0 Deg F (Minus 17 Deg C) starting temperature.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Above: Electromagnetic type designed for use with high-output lamps.

2.4 HIGH-INTENSITY-DISCHARGE (HID) LAMP BALLASTS

A. General Requirements for Magnetic HID Ballast: Comply with applicable ANSI standards. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, core and coil assembly encapsulated in non-melt resin unless otherwise indicated.
2. Operating Voltage: Match system voltage.
3. Externally fused
4. Minimum Starting Temperature: Minus 22 Deg F (Minus 30 Deg C) for single lamp ballasts.
5. Normal Ambient Operating Temperature: 104 Deg F (40 Deg C).
6. Open-circuit operation that will not reduce average life.
7. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.
8. The ballast shall be in full compliance with lamp manufacturers at the time of fixture manufacture.
9. Encapsulation: manufacturer’s standard epoxy-encapsulated model design to minimize audible fixture noise.

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10. Encase ballast for outdoor use in a weather-tight enclosure with outdoor rated wiring.

B. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 Deg C.

C. Magnetic Metal Halide Ballast: Provide high power factor, constant wattage (CW) or constant wattage auto-transformer (CWA) ballast for the various voltages and wattages as shown or linear-reactor Pulse Start ballasts for pulse start wattages as shown.

D. Electronic Metal Halide Ballasts:

1. Universal input voltage of 120 volts through 277 volts.
2. Ballast factor of 1.0.
3. Constant power regulation, which provides constant light output with varying input voltage.
4. High power factor rating greater than 98%.
5. Sensing technology to shut down the lamp power when inoperative or malfunctioning lamp is present.
6. 50/60 hertz input frequency rated.
7. Low THD of less than 10%.
8. Starting temperature of –5 Deg. F/-20 Deg. C. minimum.
9. Maximum case temperature of 90 Deg. C.
10. Remote mounting up to 6 feet with capabilities up to 15 feet.
11. UL listed, Type 1, outdoor suitable for recessed use, thermally protected and sound rated A.
12. Metal halide lamp/ballast combinations shall be covered by a combined lamp/ballast warranty where applicable. Covered ballasts shall carry a 5 year warranty and include a nominal labor replacement allowance. Where lamp/ballast combinations have a combination warranty, the lamp and ballast shall be manufactured by the same company.

2.5 EXIT SIGNS

A. General Requirements: Comply with applicable UL standards for sign colors and lettering size: Comply with Authorities Having Jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours rated lamp life.
2. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

D. Visibility and Luminance Compliance: Comply with visibility and luminance requirements of NFPA 101 for exit signs.

2.6 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL standards. Units include the following features.

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.

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2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.7 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL standards.

1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.
5. Units shall be capable of powering one or two lamps for a minimum of 90 minutes with a minimum light output of 1300 lumens.

2.8 LAMPS

A. Lamps shall comply with the current Federal energy legislation [Energy Policy Act (EPACT) 1992 or latest] and meet current Federal Environmental Protection Agency (EPA) Universal Waste regulations and pass Toxic Characteristic Leaching Procedure (TCLP) test.

B. Coordinate ballast and lamp compatibility with manufacturers.

C. Fluorescent lamps shall be as described in the Lighting Fixture Schedule and as follows:

1. Linear and U-bent T8 medium bi-pin lamps

2. Correlated color temperature as indicated in the Lighting Fixture Schedule.

a. Minimum Color Rendering Index (CRI) of 85CRI.
b. Provide 10,000 operating hour lamp replacement warranty on lamps to owner.
c. Minimum initial lamp lumen output for each lamp type shall be:

1) 3000 lumens for 4' F032T8XP.
2) 1400 lumens for 2' F017T8XP.
3) 2250 lumens for 3' F025T8XP.
4) 3870 lumens for 5' F040T8XP.
5) 6200 lumens for 8' F096T8XP.
6) 2900 lumens for 2' U-Bent 6" leg-spaced FB032XP.
7) 2800 lumens for 2' U-Bent 1 5/8" leg-spaced FB031XP.

d. Average rated life at 3 hours per start on electronic ballast shall be:

1) 24,000 hours for 4' T8.
2) 24,000 hours for 2', 3', and 5' T8.
3) 24,000 hours for U-Bent T8.
4) 18,000 hours for 8' T8.

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3. Twin tube T5 compact fluorescent lamps.

a. Coordinate T5 diameter lamp with electronic ballasts equipped with shutdown circuit
b. Average rated life at 3 hours per start on electronic ballasts shall be 20,000 hours.
c. Provide 10,000 operating hour lamp replacement warranty on lamps to owner, including dimming applications.
d. Correlated color temperature as indicated in the Lighting Fixture Schedule.
e. Minimum color rendering index 82CRI
f. Minimum initial lamp lumen output for each 2G11-base lamp shall be:

1) 3150 lumens for 22.6" FT40W/2G11
2) 4800 lumens for 21.1" FT55W/2G11
3) 2900 lumens for 16.6" FT36W/2G11
4) 1800 lumens for 12.9" FT36W/2G11
5) 1250 lumens for 9.0" and 10.5" FT18W/2G11

D. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 Deg.K and 70 CRI or higher, unless otherwise indicated.

1. Lamps and ballasts must be compatible.
2. All metal halide lamps for indoor use shall be coated lamps.
3. All low wattage metal halide lamps (less than or equal to 150 watts) shall contain a protective shroud or other suitable containment material for use in open fixtures.
4. Refer to the Lighting Fixture Schedule for specific lamp requirements.

E. High Pressure Sodium Lamps: Lamps shall be rated for 24,000 hours, be coated, have a CRI rating of 60 or higher, and have a color temperature of 2200 Deg. K.

2.9 FINISHES

A. General: Manufacturer's standard, unless otherwise indicated.

B. Paint Finish: Factory applied over corrosion-resistant treatment or primer, free or defects. Apply after fixture body has been fabricated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions, authority having jurisdiction, and approved submittal materials. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install ceiling support system rods or wires from the structure for each fixture as required by the authority having jurisdiction.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees or as required by the authority having jurisdiction.

C. Suspended Fixture Support: :

1. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

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2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions, complete with escutcheons, etc.and details on Drawings.
4. Grounding: Continuous rows of light fixtures shall be provided with properly connected continuous ground system.
5. Attachment: All suspended fixtures shall be supported with proper connections to the building structure.

D. Fixture Start-up:

1. Fluorescent lamps shall be operated continuously for 24 hours after the fixtures have been energized.
2. HID lamps shall be operated continuously for 100 hours after the fixtures have been energized.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Operational Testing: Perform operational and functional testing as follows to verify performance:

1. Verify normal operation of each fixture after installation.
2. Interrupt electrical supply to emergency lighting fixtures to demonstrate proper operation. Verify normal transfer to battery source and retransfer to normal.
3. Report results in writing.

C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.3 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

C. Dispose of defective and/or broken lamps per EPA and manufacturer's requirements.

3.4 LIGHTING FIXTURE SCHEDULE

A. Refer to the "Lighting Fixture Schedule" on the Drawings.

END OF SECTION 16510

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SECTION 16710 - BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA TIA-455-21-A	(1988) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
IA TIEIA-492AAAA-A	(1998) 62.5-um Core Diameter/125-umCladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAA-A)
EIA TIA/EIA-492AAAB	(1998; R2002) 50-Um Core Diameter/125-Um Cladding Diameter Class IA Graded-Index Multimode Optical Fibers
EIA TIA/EIA-492CAAA	(1998; R 2002) Class IVA Dispersion-Unshifted Single-Mode Optical Fibers
EIA TIA/EIA-526-14A	(1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)
EIA TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)
EIA TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
EIA TIA/EIA-568-B.2	(2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)
EIA TIA/EIA-568-B.3	(2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
EIA TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
EIA TIA/EIA-598-B	(2001) Optical Fiber Cable Color Coding
EIA TIA/EIA-604-12	(2000) FOCIS 12 Fiber Optic Connector Intermateability Standard Type MT-RJ
EIA TIA/EIA-604-2	(1997; R 2002) FOCIS 2 Fiber Optic Connector Intermateability

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	Standard
EIA TIA/EIA-604-3A	(2000) FOCIS 3 Fiber Optic Connector Intermateability Standard - Standard Type SC
EIA TIA/EIA-606-A	(2002) Administration Standard for the Telecommunications Infrastructure (ANSI/TIA/EIA-606)

2. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 100	(2000) The authorative Dictionary of IEEE Standards Terms

3. INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596	(2001) Fiber Optic Premises Distribution Cable
ICEA S-90-661	(2002) Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communications Wiring Systems

4. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 63.1	(2000) Twisted Pair Premise Voice and Data Communications Cables
NEMA WC 66	(2001) Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

5. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code

6. UNDERWRITERS LABORATORIES (UL)

UL 1863	(2004) Communication Circuit Accessories
UL 444	(2002; Rev thru Aug 2002) Communications Cables
UL 514C	(1996; Rev thru Nov 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Rev thru Nov 2001) Marking and Labeling Systems

7. U.S. AIR FORCE (USAF)

ETL 02-12	Communications and Information Criteria for Air Force Facilities

1.2

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1.3 RELATED REQUIREMENTS

A. Section 16402 INTERIOR DISTRIBUTION SYSTEM apply to this section with additions and modifications specified herein.

1.4 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, EIA TIA/EIA-569-A, EIA TIA/EIA-606-A and IEEE Std 100 and herein.

B. Telecommunications Room (TR)

1. An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

C. Open Cable

1. Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

D. Pathway

1. A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.5 SYSTEM DESCRIPTION

A. The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for terminating cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology. Provide telecommunications pathway systems referenced herein as specified in Section 16402 INTERIOR DISTRIBUTION SYSTEM.

1.6 SUBMITTALS

A. Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are [for Contractor Quality Control approval or information only.
When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1. SD-03 Product Data

Telecommunications cabling; G

Telecommunications outlet/connector assemblies; G,

Connector blocks; G

Spare Parts; G

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Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Manufacturer Qualifications; G

Test plan; G

SD-09 Manufacturer's Field Reports

Factory reel tests; G

SD-11 Closeout Submittals

Record Documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.1.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.1.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of

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current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor’s key personnel require approval from The Contracting Officer.

1.6.1.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3.

1.6.2 Test Plan

Provide a complete and detailed test plan for the telecommunications
cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories 60 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

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1.6.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with EIA TIA/EIA-606-A. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in hard copy format and on electronic media using Windows based computer cable management software. Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided in accordance with EIA TIA/EIA-606-A. The cable records shall [include only the required data fields][include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility]in accordance with EIA TIA/EIA-606-A. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with EIA TIA/EIA-606-A. Documentation shall include the required data fields as a minimum only in accordance with EIA TIA/EIA-606-A.

PART 2 PRODUCTS

2.1 COMPONENTS

UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and

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components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, ETL 02-12, and NFPA 70. Provide a labeling system for cabling as required by EIA TIA/EIA-606-A and UL 969. Ship cable on reels bearing manufacture date for UTP in accordance with ICEA S-90-661and optical fiber cables in accordance with ICEA S-83-596] for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.2.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with EIA TIA/EIA-568-B.1 and ETL 02-12.

2.2.1.1 Horizontal Copper

Provide horizontal copper cable in accordance with ETL 02-12, EIA TIA/EIA-568-B.2, UL 444, NEMA WC 66, ICEA S-90-661, UTP(unshielded twisted pair), 100 ohm. Provide four each individually twisted pair, 24 AWG conductors, Category 6, with a thermoplastic jacket, color as directed by the Contracting officer. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70.

2.2.1.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with ETL 02-12, EIA TIA/EIA-568-B.3 and EIA TIA/EIA-492AAAA-A, multimode, 62.5/125-um diameter, 0.275 numerical aperture, EIA TIA/EIA-492AAAB, multimode, 50/125-um diameter, 0.275 numerical aperture EIA TIA/EIA-492CAAA, single-mode, 8/125-um diameter, 0.10 numerical aperture], tight buffered fiber optic cables. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 40 inches. Provide nonconductive optical fiber general purpose cable (OFN or OFNG), nonconductive optical fiber riser cable (OFNR) or nonconductive optical fiber plenum cable (OFNP) in accordance with NFPA 70. Type OFNP or OFNR may be substituted for type OFN or OFNG and type OFNP may be substituted for type OFNR in accordance with NFPA 70. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group in accordance with EIA TIA/EIA-598-B.

2.3 TELECOMMUNICATION SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment room to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with EIA TIA/EIA-606-A.

2.3.1 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 5e and higher systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 10 percent spare.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.4.1 Outlet/Connector Copper

Outlet/connectors shall comply with ETL 02-12, FCC Part 68EIA TIA/EIA-568-B.1, and EIA TIA/EIA-568-B.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic

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housing and shall be third party verified and shall comply with EIA TIA/EIA-568-B.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568A or as indicated by the Contracting Officer. UTP outlet/connectors shall comply with EIA TIA/EIA-568-B.2 for 200 mating cycles.

2.4.2 Optical Fiber Adapters

Provide optical fiber adapters suitable for duplex SC in accordance with ETL 02-12, EIA TIA/EIA-604-3A with zirconia ceramic alignment sleeves, MT-RJ in accordance with EIA TIA/EIA-604-12 with thermoplastic alignment sleeves, and ST in accordance with EIA TIA/EIA-604-2 with metallic alignment sleeves as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with EIA TIA-455-21-A for 500 mating cycles.

2.4.3 Optical Fiber Connectors

Provide in accordance with ETL 02-12 and EIA TIA-455-21-A. Optical fiber connectors shall be duplex SC in accordance with EIA TIA/EIA-604-3A with zirconia ceramic MT-RJ in accordance with EIA TIA/EIA-604-12 with thermoplastic and ST in accordance with EIA TIA/EIA-604-2 with metallic ferrule, epoxyless crimp style compatible with[[62.5/125][50/125] multimode][8/125 single-mode] fiber. The connectors shall provide a maximum attenuation of 0.3 dB @ 850 nm for multimode and 1310 nm for single mode with less than a 0.2 dB change after 500 mating cycles.

2.4.4 Cover Plates

Telecommunications cover plates shall comply with ETLL02-12, UL 514C, and EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3; flush design constructed of high impact thermoplastic material in color to match color of receptacle/switch cover plates specified in Section 16402 INTERIOR DISTRIBUTION SYSTEMS or 302 stainless material. Provide labeling in accordance with the paragraph LABELING in this section.

2.5 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00, FIRESTOPPING.

2.6 TESTS, INSPECTIONS, AND VERIFICATIONS

2.6.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.3, EIA TIA/EIA-526-7 for single mode optical fiber, and EIA TIA/EIA-526-14A for multimode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with ETL 02-12, EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, EIA TIA/EIA-569-A, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Provide residential cabling in a star wiring architecture from the distribution device as required by EIA TIA/EIA-570-B. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

3.1.1 Cabling

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Install Category 6 UTP and optical fiber telecommunications cabling system as detailed in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, and ETL 02-12. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 ft. in the telecommunications room, and 12 inches in the work area outlet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Install in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings between the building telecommunications room and the telecommunications outlet assemblies at workstations.

3.1.2 Work Area Outlets

3.1.2.1 Terminations

Terminate UTP cable in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and wiring configuration as specified. Terminate fiber optic cables in accordance with EIA TIA/EIA-568-B.3

3.1.2.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph
LABELING in this section.

3.1.2.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.2.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.3 Telecommunications Space Termination

Install termination hardware required for [Category 5e,][Category 6][and][optical fiber] system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.3.1 Connector Blocks

Connector blocks shall be wall mounted in orderly rows and columns. Adequate vertical and horizontal wire routing

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areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with EIA TIA/EIA-569-A.

3.1.4 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07840,
FIRESTOPPING.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with EIA TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with EIA TIA/EIA-606-A.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with EIA TIA/EIA-606-A.

3.3 TESTING

3.3.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and
performance tests in accordance with ETL 02-12, EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.3.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.3.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination, but not cross-connected.

For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-B.3 and EIA TIA/EIA-526-14A using Method A, Optical Power Meter and Light Source for multimode optical fiber. For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-B.3 and EIA TIA/EIA-526-7 using Method A, Optical Power Meter and Light Source for single-mode optical fiber. Perform verification acceptance tests.

3.3.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

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a. Perform Category 6 link tests in accordance with EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with EIA TIA/EIA-568-B.3.

-- End of Section --

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SECTION 28 31 64.00 10

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(2002) Installation, Maintenance and Use of Emergency Services Communications Systems
NFPA 70	(2005) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code
NFPA 90A	(2002) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 1971	(2002; Rev thru May 2004) Signaling Devices for the Hearing Impaired
UL 268	(1996; Rev thru Oct 2003) Smoke Detectors for Fire Alarm Signaling Systems
UL 38	(1999; Rev thru Jun 2001) Manual Signaling Boxes for Fire Alarm Systems
UL 464	(2003; Rev thru Oct 2003) Audible Signal Appliances
UL 521	(1999; Rev thru Oct 2002) Heat Detectors for Fire Protective Signaling Systems
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 797	(2004) Electrical Metallic Tubing -- Steel
UL 864	(2003; Rev thru Oct 2003) Control Units and Accessories for Fire Alarm Systems

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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, as specified.

SD-03 Product Data

Storage Batteries

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Low Battery Voltage

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts

Spare parts data for each different item of material and equipment specified, not later than [3] [_____] months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [1] [_____] year of service.

Technical Data and Computer Software; G

Technical data which relates to computer

software.

Testing

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level [3] [4] Fire Alarm
Technician, for the fire detection and alarm system [60] [_____] days prior to performing system tests.

SD-06 Test Reports

Testing

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report

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shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G

[Six] [_____] copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. [Six] [_____] copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

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1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on
the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

b. A registered professional engineer (P.E.) in fire protection engineering.

1.3.8 Detail Drawings

The Contractor shall submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram
shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

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1.4 SYSTEM DESIGN

1.4.1 Interface With Existing Fire Alarm Equipment

The equipment specified herein shall operate as an extension to an existing configuration. The new equipment shall be connected to an existing control panel in the existing part of the building. Existing control equipment shall be expanded, modified, or supplemented as necessary to extend the existing control and monitoring functions to the new points or zones. New components shall be capable of merging with the existing configuration without degrading the performance of either system. The scope of the acceptance tests of paragraph Testing shall include aspects of operation that involve combined use of both new and existing portions of the final configuration.

1.4.2 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.2 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a [Style D] [Style B] initiating device circuits. The system shell be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.3 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.4 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.5 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall

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be connected into signal line circuits. Stations shall be installed on recessed mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.6 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.6.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination fixed temperature and rate-of-rise principle. Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70 and as shown on drawings, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.6.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 57.2 degrees C 135 degrees F. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 15 by 15 m 50 by 50 ft.

2.6.2 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.6.2.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.7 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface

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mounted audible appliances shall be painted red.

2.7.2 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed. Horns shall produce a sound rating of at least 85 dBA at 3.05 m 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.7.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be surface mounted.

2.7.4 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individualunits except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.8 FIRE DETECTION AND ARARM SYSTEM PERIPHERAL EQUIPMENT

2.8.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.8.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturer's requirements. Wiring for the fire alarm dc circuits shoal be No. 14 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or t-tap connection to initiating device circuits, supervisory alarm circuits, and notifications appliance circuits are prohibited. T-tapping using screw terminal block is allowed for style 5 addressable systems.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits depending on existing system. Detectors shall be at least 300 mm 12 inches from any part of any lighting fixture. Detectors shall be located at least 900 mm 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD.

3.1.5 Notification Appliances

Notification appliances shall be mounted 2003 mm 80 inches above the finished floor or 150 mm 6 inches below the ceiling, whichever is lower.

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3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.2.2 Low Voltage DC Circuits Surge Protection

All [IDC] [IDC, NAC, and communication cables/conductors], except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 Additions to Existing Facilities

Supplemental components shall be added to the existing supervising equipment as required to accommodate the new fire alarm system to be as indicated on the drawings. All present functions shall be extended, including recording and storage in memory, and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been

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degraded and that the expanded configuration operates compatibly with the new fire alarm system.

3.5 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.5.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.5.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault.

k. Short circuit faults.

l. Stray voltage.

m. Loop resistance.

3.6 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training day and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 1 training day and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or

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modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least 1 training day and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

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